# CHAPTER 4

# EMERGENCY MEDICAL CARE PROCEDURES

For a Navy Corpsman, the terms "first aid" and "emergency medical procedures" relate to the professional care of the sick and injured before in-depth medical attention can be obtained. Appropriate care procedures may range from providing an encouraging word to performing a dramatic struggle to draw a person back from the brink of death. Always remember, however, that first aid measures are temporary expedients to save life, to prevent further injury, and to preserve resistance and vitality. These measures are not meant to replace proper medical diagnosis and treatment procedures. Hospital Corpsmen will be able to provide the competent care that makes the difference between life or death, temporary or permanent injury, and rapid recovery or long-term disability if they

- understand the relationship between first aid and proper medical diagnosis and treatment,
- know the limits of the professional care Corpsmen can offer, and
- keep abreast of new emergency medical equipment.

## GENERAL FIRST AID RULES

**LEARNING OBJECTIVE:** *Recall general first aid rules.*

There are a few general first aid rules that you should follow in any emergency:

1. Take a moment to get organized. On your way to an accident scene, use a few seconds to remember the basic rules of first aid. Remain calm as you take charge of the situation, and act quickly but efficiently. Decide as soon as possible what has to be done and which one of the patient's injuries needs attention first.

2. Unless contraindicated, make your preliminary examination in the position and place you find the victim. Moving the victim before this check could gravely endanger life, especially if the neck, back, or ribs are broken. Of course, if the situation is such that you or the victim is in danger, you must weigh this threat against the potential damage caused by premature transportation. If you decide to move the victim, do it quickly and gently to a safe location where proper first aid can be administered.

3. In a multivictim situation, limit your preliminary survey to observing for airway patency, breathing, and circulation, the **ABC**s of basic life support. Remember, irreversible brain damage can occur within 4 to 6 minutes if breathing has stopped. Bleeding from a severed artery can lethally drain the body in even less time. If both are present and you are alone, quickly handle the major hemorrhage first, and then work to get oxygen back into the system. Shock may allow the rescuer a few minutes of grace but is no less deadly in the long run.

4. Examine the victim for fractures, especially in the skull, neck, spine, and rib areas. If any are present, prematurely moving the patient can easily lead to increased lung damage, permanent injury, or death. Fractures of the hip bone or extremities, though not as immediately life-threatening, may pierce vital tissue or blood vessels if mishandled.

5. Remove enough clothing to get a clear idea of the extent of the injury. Rip along the seams, if possible, or cut. Removal of clothing in the normal way may aggravate hidden injuries. Respect the victim's modesty as you proceed, and do not allow the victim to become chilled.

6. Keep the victim reassured and comfortable. If possible, do not allow the victim to see the wounds. The victim can endure pain and discomfort better if confident in your abilities. This is important because under normal conditions the Corpsman will not have strong pain relief medications right at hand.

7. Avoid touching open wounds or burns with your fingers or unsterile objects, unless clean compresses and bandages are not available and it is imperative to stop severe bleeding.

8. Unless contraindicated, position the unconscious or semiconscious victim on his side or back, with the head turned to the side to minimize choking or the aspirating of vomitus. Never give an unconscious person any substance by mouth.

9. Always carry a litter patient feet first so that the rear bearer can constantly observe the victim for respiratory or circulatory distress.

## TRIAGE

**LEARNING OBJECTIVE:** *Recognize the protocols for tactical and nontactical triage.*

Triage, a French word meaning "to sort," is the process of quickly assessing patients in a multiple-casualty incident and assigning patient a priority (or classification) for receiving treatment according to the severity of his illness or injuries. In the military, there are two types of triage, tactical and nontactical, and each type uses a different set of prioritizing criteria. The person in charge is responsible for balancing the human lives at stake against the realities of the tactical situation, the level of medical stock on hand, and the realistic capabilities of medical personnel on the scene. Triage is a dynamic process, and a patient's priority is subject to change as the situation progresses.

### SORTING FOR TREATMENT (TACTICAL)

The following discussion refers primarily to battalion aid stations (BAS) (where neither helicopter nor rapid land evacuation is readily available) and to shipboard battle-dressing stations.

Immediately upon arrival, sort the casualties into groups in the order listed below.

**Class I** Patients whose injuries require minor professional treatment that can be done on an outpatient or ambulatory basis. These personnel can be returned to duty in a short period of time.

**Class II** Patients whose injuries require immediate life-sustaining measures or are of a moderate nature. Initially, they require a minimum amount of time, personnel, and supplies.

**Class III** Patients for whom definitive treatment can be delayed without jeopardy to life or loss of limb.

**Class IV** Patients whose wounds or injuries would require extensive treatment beyond the immediate medical capabilities. Treatment of these casualties would be to the detriment of others.

### SORTING FOR TREATMENT (NONTACTICAL)

In civilian or nontactical situations, sorting of casualties is not significantly different from combat situations. There are four basic classes (priorities) of injuries, and the order of treatment of each is different.

**Priority I** Patients with correctable life-threatening illnesses or injuries such as respiratory arrest or obstruction, open chest or abdomen wounds, femur fractures, or critical or complicated burns.

**Priority II** Patients with serious but non-life-threatening illnesses or injuries such as moderate blood loss, open or multiple fractures (open increases priority), or eye injuries.

**Priority III** Patients with minor injuries such as soft tissue injuries, simple fractures, or minor to moderate burns.

**Priority IV** Patients who are dead or fatally injured. Fatal injuries include exposed brain matter, decapitation, and incineration.

As mentioned before, triage is an ongoing process. Depending on the treatment rendered, the amount of time elapsed, and the constitution of the casualty, you may have to reassign priorities. What may appear to be a minor wound on initial evaluation could develop into a case of profound shock. Or a casualty who required initial immediate treatment may be stabilized and downgraded to a delayed status.

### SORTING FOR EVACUATION

During the Vietnam war, the techniques for helicopter medical evacuation (MEDEVAC) were so effective that most casualties could be evacuated to a major medical facility within minutes of their injury. This considerably lightened the load of the Hospital Corpsman in the field, since provision for long-term care before the evacuation was not normally required. However, rapid aeromedical response did not relieve the Corpsman of the responsibility for giving the best emergency care within the field limitations to stabilize the victim before the helicopter arrived. Triage was seldom needed since most of the injured could be evacuated quickly.

New developments in warfare, along with changes in the theaters of deployment, indicate that the helicopter evacuation system may no longer be viable

in future front-line environments. If this becomes the case, longer ground chains of evacuation to the battalion aid station or division clearing station may be required. This will increase the need for life-stabilizing activities before each step in the chain and in transit. Evacuation triage will normally be used for personnel in the Class II and Class III treatment categories, based on the tactical situation and the nature of the injuries. Class IV casualties may have to receive treatment at the BAS level, and Class I personnel will be treated on the line.

Remember, triage is based on the concept of saving the maximum number of personnel possible. In some cases, a casualty may have the potential to survive, but to ensure that casualty's survival, the treatment necessary may require a great deal of time and supplies. As difficult as it may be, you may have to forsake this patient to preserve the time and supplies necessary to save others who have a greater potential for survival.

## PATIENT ASSESSMENT IN THE FIELD

**LEARNING OBJECTIVE:** *Recognize the assessment sequence for emergency medical care in the field, and identify initial equipment and supply needs.*

Patient assessment is the process of gathering information needed to help determine what is wrong with the patient. Assessments that you conduct in the field (at the emergency scene) or during transport are known as a field assessments.

Field assessments are normally performed in a systematic manner. The formal processes are known as the **primary survey** and the **secondary survey**. The primary survey is a rapid initial assessment to detect and treat life-threatening conditions that require immediate care, followed by a status decision about the patient's stability and priority for immediate transport to a medical facility. The secondary survey is a complete and detailed assessment consisting of a subjective interview and an objective examination, including vital signs and head-to-toe survey. (Both types of surveys will be discussed in more detail later in this chapter.)

### BEFORE ARRIVAL AT THE SCENE

Before or during transit to an emergency scene, you may learn about the patient's illness or injury. Although this information could later prove to be erroneous, you should use this time to consider what equipment you may need and what special procedures you should use immediately upon arrival.

### ARRIVAL AT THE SCENE

When you arrive at an emergency scene, you need to start gathering information immediately. First, make sure the scene is safe for yourself, then for the patient or patients. Do not let information you received before your arrival form your complete conclusion concerning the patient's condition. Consider all related factors before you decide what is wrong with the patient and what course of emergency care you will take.

You can quickly gain valuable information as to what may be wrong with the patient. Observe and listen as you proceed to your patient. Do not delay the detection of life-threatening problems. Be alert to clues that are obvious or provided to you by others. Some immediate sources of information may come from the following:

- **The scene**—Is it safe or hazardous? Does the patient have to be moved? Is the weather severe?
- **The patient**—Is the patient conscious, trying to tell you something, or pointing to a part of his body?
- **Bystanders**—Are they trying to tell you something? Listen. They may have witnessed what happened to the patient or have pertinent medical history of the patient (for example, prior heart attacks).
- **Medical identification device**—Is the patient wearing a medical identification device (necklace or bracelet)? Medical identification devices can provide you with crucial information on medical disorders, such as diabetes.
- **Mechanism of injury**—Was there a fire? Did the patient fall or has something fallen on the patient? Is the windshield of vehicle cracked or the steering wheel bent?
- **Deformities or injuries**—Is the patient lying in a strange position? Are there burns, crushed limbs, or other obvious wounds?
- **Signs**—What do you see, hear, or smell? Is there blood around the patient? Has the patient vomited? Is the patient having convulsions? Are the patient's clothes torn?

## PRIMARY SURVEY

As stated earlier, the primary survey is a process carried out to detect and treat **life-threatening conditions**. As these conditions are detected, lifesaving measures are taken immediately, and early transport may be initiated. The information acquired before and upon your arrival on the scene provides you with a starting point for the primary survey. The primary survey is a "treat-as-you-go" process. As each major problem is detected, it is treated immediately, before moving on to the next.

During the primary survey, you should be concerned with what are referred to as the **ABCDE**s of emergency care: airway, breathing, circulation, disability, and expose.

**A=Airway**. An obstructed airway may quickly lead to respiratory arrest and death. Assess responsiveness and, if necessary, open the airway.

**B=Breathing**. Respiratory arrest will quickly lead to cardiac arrest. Assess breathing, and, if necessary, provide rescue breathing. Look for and treat conditions that may compromise breathing, such as penetrating trauma to the chest.

**C=Circulation**. If the patient's heart has stopped, blood and oxygen are not being sent to the brain. Irreversible changes will begin to occur in the brain in 4 to 6 minutes; cell death will usually occur within 10 minutes. Assess circulation, and, if necessary, provide cardiopulmonary resuscitation (CPR). Also check for profuse bleeding that can be controlled. Assess and begin treatment for severe shock or the potential for severe shock.

**D=Disability**. Serious central nervous system injuries can lead to death. Assess the patient's level of consciousness and, if you suspect a head or neck injury, apply a rigid neck collar. Observe the neck before you cover it up. Also do a quick assessment of the patient's ability to move all extremities.

**E=Expose**. You cannot treat conditions you have not discovered. Remove clothing–especially if the patient is not alert or communicating with you–to see if you missed any life-threatening injuries. Protect the patient's privacy, and keep the patient warm with a blanket if necessary.

As soon as the ABCDE process is completed, you will need to make what is referred to as a **status decision** of the patient's condition. A status decision is a judgment about the severity of the patient's condition and whether the patient requires immediate transport to a medical facility without a secondary survey at the scene. Ideally, the ABCDE steps, status, and transport decision should be completed within 10 minutes of your arrival on the scene.

## SECONDARY SURVEY

The object of a secondary survey is to detect medical and injury-related problems that do not pose an immediate threat to survival but that, if left untreated, may do so. Unlike the primary survey, the secondary survey is not a "treat-as-you-go" process. Instead, you should mentally note the injuries and problems as you systematically complete the survey. Then you must formulate priorities and a plan for treatment.

The secondary survey for a patient who presents with medical illness is somewhat different from that of an injured patient. Usually the **trauma assessment** is about 20 percent patient interview and 80 percent physical exam. On the other hand, the **medical assessment** is 80 percent patient interview and 20 percent physical exam. Both the physical exam and patient interview should always be done for all medical and trauma patients.

> **NOTE:** Remember, if the patient's condition deteriorates, it may not be possible to complete the secondary survey before starting to transport the patient.

### Subjective Interview

The subjective interview is similar to the interview physicians make before they perform a physical examination. The main objective of the interview is to gather needed information from the patient. Other objectives of the interview are to reduce

the patient's fear and promote cooperation. Whenever possible, conduct the subjective interview while you are performing the physical examination.

Relatives and bystanders at the emergency scene may also serve as sources of information, but you should not interrupt interviewing the patient to gather information from a bystander. If the patient is unconscious, you may obtain information from bystanders and medical identification devices while you are conducting the physical examination.

When conducting a patient interview, you should take the following steps:

1. **Place yourself close to the patient.** Position yourself, when practical, so the patient can see your face. If at all possible, position yourself so that the sun or bright lights are not at your back. The glare makes it difficult for the patient to look at you.
2. **Identify yourself and reassure the patient.** Identify yourself and maintain a calm, professional manner. Speak to the patient in your normal voice.
3. **Learn your patient's name.** Once you learn the patient's name, you should use it during the rest of your interview. Children will expect you to use their first name. For military adults, use the appropriate rank. If civilian, use "Mr." or "Ms." unless they introduce themselves by their first name.
4. **Learn your patient's age.** Age information will be needed for reports and communications with the medical facility. You should ask adolescents their age to be certain that you are dealing with a minor. With minors, always ask how you can contact their parent or guardian. Sometimes this question upsets children because it intensifies their fear of being sick or injured. Be prepared to offer comfort and assure children that someone will contact their parents or guardians.
5. **Seek out what is wrong.** During this part of the interview, you are seeking information about the patient's symptoms and what the patient feels or senses (such as pain or nausea). Also, find out what the patient's chief complaint is. Patients may give you several complaints, so ask what is bothering them most. Unless there is a spinal injury that has interrupted nerve pathways, most injured individuals will be able to tell you of painful areas.
6. **Ask the PQRST questions if the patient is experiencing pain or breathing difficulties.**

   **P=Provocation**—What brought this on?

   **Q=Quality**—What does it feel like?

   **R=Region**—Where is it located?

   **R=Referral**—Does it go anywhere (e.g., "into my shoulder")?

   **R=Recurrence**—Has this happened before?

   **R=Relief**—Does anything make it feel better?

   **S=Severity**—How bad is it on a scale of 1 to 10?

   **T =Time**—When did it begin?
7. **Obtain the patient's history by asking the AMPLE questions.**

   **A=Allergies**—Are you allergic to any medication or anything else?

   **M=Medications**—Are you currently taking any medication?

   **P=Previous medical history**—Have you been having any medical problems? Have you been feeling ill? Have you been seen by a physician recently?

   **L=Last meal**—When did you eat or drink last? (Keep in mind, food could cause the symptoms or aggravate a medical problem. Also, if the patient requires surgery, the hospital staff will need to know when the patient has eaten last.)

   **E=Events**—What events led to today's problem (e.g., the patient passed out and then got into a car crash)?

**Objective Examination**

The objective examination is a comprehensive, hands-on survey of the patient's body. During this examination, check the patient's vital signs and observe the signs and symptoms of injuries or the effects of illness.

When you begin your examination of the patient, you should heed the following rules:

1. Obtain the patient's consent (if the patient is alert).
2. Tell the patient what you are going to do.

3. Always assume trauma patients have a spinal injury, especially unconscious trauma patients, unless you are certain you are dealing with a patient free from spinal injury (e.g., a medical patient with no trauma).

**HEAD-TO-TOE SURVEY**.—The head-to-toe survey is a systematic approach to performing a physical examination. This survey is designed so nothing important is missed during the examination of the patient. There may be variations in the head-to-toe survey depending on local guidelines. Traditionally, the examination is started with the head. However, most medical authorities now recommend that the neck be examined first in an effort to detect possible spinal injuries and any serious injury to the trachea that may lead to an airway obstruction.

During the head-to-toe survey, you should

- **look** for discolorations, deformities, penetrations, wounds, and any unusual chest movements;
- **feel** for deformities, tenderness, pulsations, abnormal hardness or softness, spasms, and skin temperature;
- **listen** for changes in breathing patterns and unusual breathing sounds; and
- **smell** for any unusual odors coming from the patient's body, breath, or clothing.

The head-to-toe survey may appear to be a long process, but as you practice the procedure you will find that it can be done in just a few minutes. All necessary personal protective equipment, such as exam gloves and eye protection, should be worn during your examination.

Begin the survey by kneeling at the side of the patient's head. Quickly take an overview of the patient's body (i.e., general appearance, demeanor, behavior, skin color and characteristics, etc.), then perform the 26 steps described in the following sections.

**Step 1**.—**Check the cervical spine for point tenderness and deformity.** To perform this procedure, gently slide your hands, palms up, under both sides of the patient's neck. Move your fingertips toward the cervical midline. Check the back of the neck from the shoulders to the base of the skull. Apply gentle finger pressure. A painful response to this pressure is **point tenderness**.

If there are signs of possible spinal injury, such as midline deformities, point tenderness, or muscle spasms, stop the survey and provide stabilization of the head and neck.

> **NOTE:** If a rigid cervical collar is to be applied, make sure you have examined the posterior, anterior, and sides of the neck before applying the collar.

**Step 2**.—**Inspect the anterior neck for indications of injury and neck breathing.** This procedure consists of exposing the anterior neck to check for injury and to detect the presence of a surgical opening (stoma) or a metal or plastic tube (tracheostomy). The presence of a stoma or tracheostomy indicates the patient is a neck breather. Also, if you have not already done so in the primary survey, check for a medical identification necklace. A necklace may state the patient has a stoma or tracheostomy.

Look for signs of injury, such as the larynx or trachea deviated from the midline of the neck, bruises, deformities, and penetrating injuries. Also, check for distention of the jugular vein. If the jugular vein is distended, there may be an airway obstruction, a cervical spine injury, damage to the trachea, or a serious chest injury. All of these conditions require immediate medical care.

After the anterior neck is inspected and if a spinal injury is suspected, apply a rigid cervical or extrication collar. If the patient is unconscious, assume the patient has a spinal injury.

**Step 3**.—**Inspect the scalp for wounds.** Use extreme caution when inspecting the scalp for wounds. Pressure on the scalp from your fingers could drive bone fragments or force dirt into wounds. Also, DO NOT move the patient's head, as this could aggravate possible spinal injuries. To inspect the scalp, start at the top of the head and gently run your gloved fingers through the patient's hair. If you come across an injury site, DO NOT separate strands of the hair. To do this could restart bleeding. When the patient is found lying on his back, check the scalp of the back of the head by placing your fingers behind the patient's head. Then slide your fingers upward toward the top of the head. Check your fingers for blood. If a spinal or neck injury is suspected, delay this procedure until the head and neck have been immobilized. Furthermore, if you suspect a neck injury, DO NOT lift the head off the ground to bandage it.

**NOTE:** You may find upon inspection that the patient is wearing a hairpiece or wig. Hairpieces and wigs may be held in place by adhesive, tape, or permanent glue, so DO NOT remove them unless you suspect profuse bleeding. Attempting removal may aggravate injury or restart bleeding.

**Step 4.—Check the skull and face for deformities and depressions.** As you feel the scalp, check for depressions or bony projections. Visually examine facial bones for signs of fractures. Unless there are obvious signs of injury, gently palpate the cheekbones, forehead, and lower jaw.

**Step 5.—Examine the patient's eyes. After examining the face and scalp, move back to a side position.** Begin your examination of the eyes by looking at the patient's eyelids. Do not open the eyelids of patients with burns, cuts, or other injuries to the eyelid(s). Assume there is damage to the eye and treat accordingly. If eyelids are not injured, have patients open their eyes. To examine the eyes of unconscious patients, gently open their eyes by sliding back the upper eyelids. Keep in mind, pressure applied to the eyelid may cause further injury. When the eye has been opened, visually check the globe of the eye.

**Step 6.—Check the pupils for size, equality, and reactivity**. Using a penlight or flashlight, examine both eyes. Note pupil size and if both pupils are equal in size. Also, see if the pupils react to the beam of light. Note a slow pupil reaction to the light. Look for eye movement. Both eyes should move as a pair when they observe moving persons or objects.

**NOTE:** Check unconscious patients for contact lenses. Prompt removal of contact lenses is recommended. If removal of the lens is impractical, close the patient's eyes so the contact lenses stay lubricated.

Table 4-1 lists pupil characteristics you may encounter and the possible causes of abnormalities.

**Step 7.—Inspect the inner surfaces of the eyelids.** If there is no obvious injury to the eye, gently pull the upper lid up and the lower eyelid down, and check the color of the inner surface. Normally, the inner surfaces of the eyelids are pink. However, with blood loss they become pale; with jaundice, the surface is yellow. The inner surface of the eyelid is an excellent location to detect cyanosis (skin discoloration due to lack of oxygen), especially for patients with dark skin pigmentation. Cyanosis is denoted by a blue color.

**Table 4-1.—Listing of Pupil Characteristics and the Possible Cause of Abnormality**

| PUPIL CHARACTERISTICS | POSSIBLE CAUSE OF ABNORMALITY |
|---|---|
| Dilated and unresponsive | • Cardiac arrest<br>• Influence of drugs (e.g., LSD and amphetamines) |
| Constricted and unresponsive | • Central Nervous System disease or disorder<br>• Influence of narcotics (e.g., heroin, morphine, or codeine) |
| Unequal | • Stroke<br>• Head injury |
| Lackluster (dull) and pupils do not appear to focus | • Shock<br>• Coma |

**Step 8.—Inspect the ears and nose for injury and the presence of blood or clear fluids**. Without rotating the patient's head, inspect the ears and nose for cuts, tears, or burns. Use a penlight to look in the ears and nose for blood, clear fluids, or bloody fluids. Blood in the ears and clear fluids (cerebrospinal fluid) in the ears or nose are strong indicators of a skull fracture. Also, check for bruises behind the ears, commonly referred to as **Battle's sign**. Bruises behind the ears are strong indicators of skull fracture and cervical spine injury. Burned or singed nasal hairs indicate possible burns in the airway.

**Step 9.—Inspect the mouth**. Look inside the mouth for signs of airway obstruction that may not have been observed during the primary survey (e.g., loose or broken teeth, dentures, and blood). When you inspect the mouth, remember not to rotate the patient's head.

**Step 10.—Smell for odd breath odors.** Place your face close to the patient's mouth and nose and note any unusual odors. A fruity smell indicates diabetic coma or prolonged vomiting and diarrhea; a petroleum odor indicates ingested poisoning; and an alcohol odor indicates possible alcohol intoxication.

**Step 11**.—Inspect the chest for wounds. Expose the chest. For unconscious and trauma patients, you should completely remove clothing to expose the chest. (Try to provide as much privacy as possible for patients.) Look for obvious chest injuries, such as cuts, bruises, penetrations, objects impaled in the chest, deformities, burns, or rashes. If puncture or bullet wounds are found, check for exit wounds when inspecting the back.

**Step 12**.—**Examine the chest for possible fracture.** Before you begin examining the chest for fractures, warn the patient that the examination may be painful. Begin your examination by gently feeling the clavicles (collarbones). Next, feel the sternum (breastbone). Then examine the rib cage by placing your hands on both sides of the rib cage and applying gentle pressure. This process is known as **compression**. If the patient has a fracture, compression of the rib cage will cause pain. Finally, slide your hands under the patient's scapulae (shoulder blades) to feel for deformities or tenderness.

Point tenderness, painful reaction to compression, deformity, or grating sounds indicate a fracture. If air is felt (like crunching popcorn) or heard (crackling sounds) under the skin, this indicates that at least one rib is fractured or that there is a pneumothorax (punctured lung). You may also observe air escaping the chest cavity and the wound when the patient has a punctured lung.

**Step 13**.—**Check for equal expansion of the chest.** Check chest movements and feel for equal expansion by placing your hand on both sides of the chest. Be alert to sections of the chest that seem to be "floating" (flail chest) or moving in a direction opposite to the rest of the chest during respiration.

**Step 14**.—**Listen for sounds of equal air entry.** Using a stethoscope, listen to both sides of the anterior and lateral chest. The sounds of air entry will usually be clearly present or clearly absent. The absence of air movement indicates an obstruction, injury, or illness to the respiratory system. Bubbling, wheezing, rubbing, or crackling sounds may indicate the patient has a medical problem or a trauma-related injury.

**Step 15**.—**Inspect the abdomen for wounds.** Look for obvious signs of injury (e.g., abdominal distension, cuts, bruises, penetrations, open wounds with protruding organs (evisceration), or burns) in all four quadrants and sides.

**Step 16**.—**Palpate the abdomen for tenderness.** Look for attempts by the patient to protect his abdomen (e.g., patient drawing up the legs). Gently palpate the entire abdomen. If the patient complains of pain in an area of the abdomen, palpate that area last. Do not palpate over an obvious injury site or where the patient is having severe pain. While palpating the abdomen, check for any tight (rigid) or swollen (distended) areas. Performing abdominal palpation is important because tender areas do not normally hurt until palpated. Note if pain is localized, general, or diffused.

**Step 17**.—**Feel the lower back for point tenderness and deformity.** Gently slide your hands under the void created by the curve of the spine. Apply gentle pressure to detect point tenderness or any deformities.

> **NOTE:** This examination of the lower back may be performed later, when the patient's entire back is exposed in preparation to being placed on a backboard or stretcher.

**Step 18**.—**Examine the pelvis for injuries and possible fractures.** Examine the pelvic area for obvious injuries. Next, gently slide your hand down both sides of the small of the patient's back and apply compression downward and then inward to check the stability of the pelvic girdle. Note any painful responses or deformities. If a grating sound is heard, the injury may involve the hip joint, or the pelvis may be fractured.

**Step 19**.—Note any obvious injury to the genital region. Look for obvious injuries, such as bleeding wounds, objects impaled in the area, or burns. Also, check for **priapism** in male patients. Priapism is a persistent erection of the penis often brought about by spinal injury or certain medical problems, such as sickle cell crisis.

**Step 20**.—**Examine the lower extremities.** DO NOT move, lift, or rearrange the patient's lower extremities (legs and feet) before or during the examination as further injury to the patient may occur. Check for signs of injury by inspecting each limb, one at a time, from hip to foot. Rearrange or remove clothing and footwear to observe the entire examination site. Pants should be removed in a manner that does not aggravate injuries. Cutting along the seams to remove pants is the best method. If the injury is not obvious, remove the shoe(s) and palpate any suspected fracture sites for point tenderness. Before palpating the site, warn the patient that this examination may cause pain. Before the patient is

moved, all suspected or known fractures should be stabilized (with splints, traction splints, or the like).

**Step 21**.—**Check for a distal pulse and capillary refill.** To make sure there are no circulatory problems in the legs or feet, check the distal pulse and capillary refill. The **distal pulse** is a pulse taken at the foot or wrist. It is called distal because the pulse is located at the distal end of the limb. The distal pulse of the foot, also referred to as **pedal pulse**, may be taken at either of two sites: the posterior tibial pulse (located behind the medial ankle) or the dorsalis pedis pulse (located on the anterior surface of the foot, lateral to the large tendon of the great toe).

You should compare the quality of the pulses in each lower limb. Absence of a distal pulse usually indicates that a major artery supplying the limb has been pinched or severed. This condition may be caused by a broken or displaced bone end or a blood clot. An absent or weak distal pulse may also result from splints or bandages being applied too tightly.

Check capillary refill by squeezing a toe (usually, the big toe) with your thumb and forefinger. The skin and nail where pressure is applied should blanch (lighten). When you release the pressure, the color (blood) should return immediately. If it takes more than 2 seconds for the color to return, capillary refill is considered delayed.

> **NOTE:** After splints or bandages are applied, check capillary refill to make sure circulation has not been impaired.

**Step 22**.—**Check for nerve function and possible paralysis of the lower extremities (conscious patient).** Check the lower extremities of conscious patients for nerve function or paralysis. First, touch a toe and ask the patient which toe it is. Do this to both feet. If the patient cannot feel your touch or if the sensations in each foot are not the same, assume that nerve damage in the limb or a spinal injury has occurred.

If sensations appear normal and no injuries are present, have the patient wave his feet. Finally, ask the patient to gently press the soles of his feet against your hand. The inability of the patient to perform any of these tasks indicates the possibility of nerve damage. When nerve damage is suspected, assume the patient has a spinal injury.

**Step 23**.—**Examine the upper extremities for injury.** Check for signs of injury to the upper extremities (arms and hands) by inspecting each limb, one at a time, from clavicle to fingertips. Rearrange or remove items of clothing to observe the entire examination site. Check for point tenderness, swelling, or bruising. Any of these symptoms may indicate a fracture. Immobilize any limb where a fracture is suspected.

**Step 24**.—**Check for a distal pulse and capillary refill.** To make sure the circulation to the upper extremities has not been compromised, confirm distal (radial) pulse. Initial check of radial pulse was performed during the primary survey. Check capillary refill of fingers or palm of hand (see step 21 for procedure). If there is no pulse or if capillary refill is delayed, the patient may be in shock or a major artery supplying the limb has been pinched, severed, or blocked.

**Step 25**.—**Check for nerve function and possible paralysis of the upper extremities (conscious patient).** Check the upper extremities of conscious patients for nerve function or paralysis. Have the patient identify the finger you touch, wave his hand, and grasp your hand. Do this to both hands. If the patient cannot feel your touch or the sensations in each hand are not the same, assume nerve damage in the limb or a spinal injury has occurred.

> **WARNING: Be alert for a rapid onset of difficult breathing or respiratory arrest. These conditions may occur to patients who have sustained a cervical injury.**

**Step 26**.—**Inspect the back and buttocks for injury.** If there is no indication of injury to the skull, neck, spine, or extremities, and you have no evidence of severe injury to the chest or abdomen, gently roll the conscious patient as a unit toward your knees and inspect the surface of the back for bleeding or obvious injuries. The back surface may be inspected prior to positioning the patient for transport or delayed until the patient is transferred to a spineboard or other immobilization device.

**VITAL SIGNS**.—Vital signs (which generally are taken after primary, secondary, and head-to-toe surveys have been completed) include taking the patient's pulse, respiration, blood pressure, and temperature. Depending on local protocols, the patient's level of consciousness as well as eye pupil size and reactivity may be recorded with vital signs. Skin characteristics, such as temperature, color, and

moistness or dryness, can also be conveniently determined at this time.

**Pulse**.—When taking a patient's pulse, you should be concerned with two factors: rate and character. For **pulse rate**, you will have to determine the number of beats per minute. Pulse rate is classified as normal, rapid, or slow. A normal pulse rate for adults is between 60 to 80 beats per minute. Any pulse rate above 100 beats per minute is rapid (**tachycardia**), while a rate below 60 beats per minute is slow (**bradycardia**).

> **NOTE**: An athlete may have a normal at-rest pulse rate between 40 and 50 beats per minute. This is a slow pulse rate, but is not an indication of poor health.

**Pulse character** is the rhythm and force of the pulse. **Pulse rhythm** is evaluated as regular or irregular. When intervals between beats are constant, the pulse is regular, and when intervals are not constant, the pulse is described as irregular. **Pulse force** refers to the pressure of the pulse wave as it expands the artery. Pulse force is determined as full or thready. A full pulse feels as if a strong wave has passed under your fingertips. When the pulse feels weak and thin, the pulse is described as thready.

The pulse rate and character can be determined at a number of points throughout the body. The most common site to determine a patient's pulse is the **radial pulse**. The radial pulse (wrist pulse) is named after the radial artery found in the lateral aspect of the forearm.

**Respiration**.—Respiration is the act of breathing. A single breath is the complete process of breathing in (**inhalation**) followed by breathing out (**exhalation**). When observing respiration in connection to vital signs, you should be concerned with two factors: rate and character.

**Respiration rate** is the number of breaths a patient takes in 1 minute. The rate of respiration is classified as normal, rapid, or slow. The normal respiration rate for an adult at rest is 12 to 20 breaths per minute. A rapid respiration rate is more than 28 respirations per minute, and a slow respiration rate is less than 10 breaths per minute. A rapid or slow respiration rate indicates the patient is in need of immediate medical attention and should be transported to a medical treatment facility as soon as possible.

**Respiration character** includes rhythm, depth, ease of breathing, and sound. **Respiration rhythm** refers to the manner in which a person breathes. Respiration rhythm is classified as regular or irregular. A regular rhythm is when the interval between breaths is constant, and an irregular rhythm is when the interval between breaths varies.

**Respiration depth** refers to the amount of air moved between each breath. Respiration depth is classified as normal, deep, or shallow.

**Ease of breathing** can be judged while you are judging depth. Ease of breathing may be judged as labored, difficult, or painful.

**Sounds of respiration** include **snoring**, **wheezing**, **crowing** (birdlike sounds), and **gurgling** (sounds like breaths are passing through water).

You should count respirations as soon as you have determined the pulse rate. Count the number of breaths taken by the patient during 30 seconds and multiply by 2 to obtain the breaths per minute. While you are counting breaths, note the rhythm, depth, ease of breathing, and sounds of respiration.

**Blood Pressure**.—The measurement of the pressure blood exerts against the wall of blood vessels is known as blood pressure. The pressure created in the arteries when the heart pumps blood out into circulation (heart beat) is called the **systolic** blood pressure. The pressure remaining in the arteries when the heart is relaxed (between beats) is called the **diastolic** blood pressure. The systolic pressure is always reported first and the diastolic pressure second (e.g., 120 over 80).

Blood pressure varies from one person to another and is measured with a stethoscope and a sphygmomanometer (BP cuff). Low blood pressure (**hypotension**) is considered to exist when the systolic pressure falls below 90 millimeters of mercury (mm Hg) and/or the diastolic falls below 60. "Millimeters of mercury" refers to the units of the BP cuff's gauge. High blood pressure (**hypertension**) exists once the pressure rises above 150/90 mm Hg. Keep in mind that patients may exhibit a temporary rise in blood pressure during emergency situations. More than one reading will be necessary to determine if a high or low reading is only temporary. If a patient's blood pressure drops, the patient may be going into shock. You should report major changes in blood pressure immediately to medical facility personnel.

**Temperature**.—Body temperatures are determined by the measurement of oral, rectal, axillary

(armpit), and aural (ear) temperatures. In emergency situations, taking a traditional body temperature may not be indicated, so a relative skin temperature may be done. A relative skin temperature is a quick assessment of skin temperature and condition. To assess skin temperature and condition, feel the patient's forehead with the back of your hand. In doing this, note if the patient's skin feels normal, warm, hot, cool, or cold. At the same time, see if the skin is dry, moist, or clammy. Also check for "goose pimples," indicating chills.

## BASIC LIFE SUPPORT

**LEARNING OBJECTIVE:** *Recall basic life support techniques for upper airway obstruction, respiratory failure, and cardiac arrest.*

Basic life support is the emergency technique for recognizing and treating upper airway obstruction and failures of the respiratory system and heart. The primary emphasis should be on the **ABC**s of basic life support: maintaining an open **airway** to counter upper airway obstruction; restoring **breathing** to counter respiratory arrest; and restoring **circulation** to counter cardiac arrest.

### UPPER AIRWAY OBSTRUCTION

The assurance of breathing takes precedence over all other emergency measures. The reason for this is simple: If a person cannot breathe, he cannot survive.

Many factors may cause a person's airway to become fully or partially obstructed. A very common cause of obstruction with both adults and children is improperly chewed food that becomes lodged in the airway (an event commonly referred to as a "cafe coronary"). Additionally, children have a disturbing tendency to swallow foreign objects while at play. Another cause for upper airway obstruction occurs during unconsciousness, when the tongue may fall back and block the pharynx (fig. 4-1). When the upper airway is obstructed, the heart will normally continue to beat until oxygen deficiency becomes acute. Periodic checks of the carotid artery must be made to ensure that circulation is being maintained.

#### Partial Airway Obstruction

The signs of partial airway obstruction include unusual breath sounds, cyanosis, or changes in breathing pattern. Conscious patients will usually make clutching motions toward their neck, even when the obstruction does not prevent speech. Encourage conscious patients with apparent partial obstructions

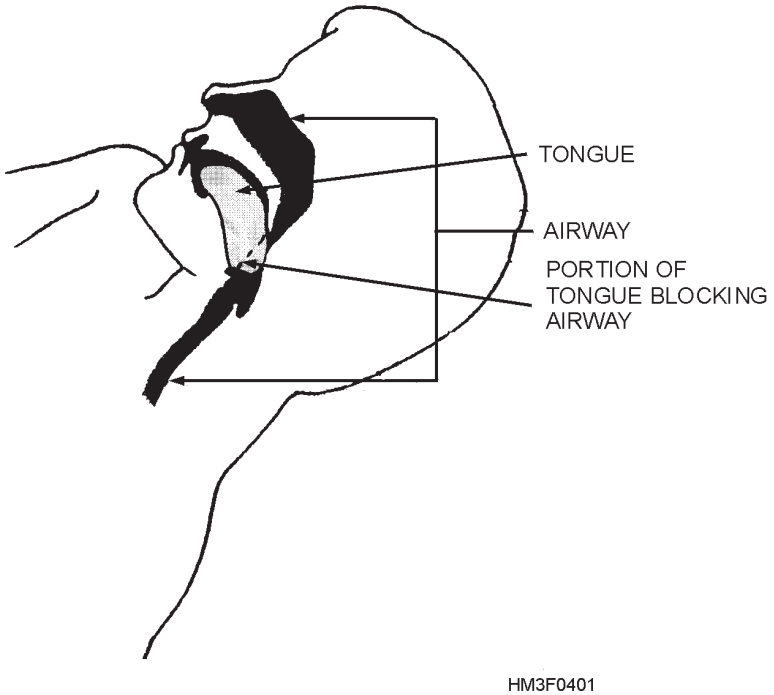


**Figure 4-1.—Tongue blocking airway.**

to cough. If the patient is unable to cough, begin to treat the patient as if this were a complete obstruction. (This also applies to patients who are cyanotic.)

**Complete Airway Obstruction**

Conscious patients will attempt to speak but will be unable to do so. Nor will they be able to cough. Usually, patients will display the universal distress signal for choking by clutching their neck. The unconscious patient with a complete airway obstruction exhibits none of the usual signs of breathing: rise and fall of the chest and air exchange through the nose and/or mouth. A complete blockage is also indicated if a correctly executed attempt to perform artificial ventilation fails to instill air into the lungs.

**Opening the Airway**

Many problems of airway obstruction, particularly those caused by the tongue, can be corrected simply by repositioning the head and neck. If repositioning does not alleviate the problem, more aggressive measures must be taken.

**POSITIONING THE PATIENT**.—When a patient is unresponsive, you must determine if he is breathing. This assessment requires the patient to be positioned properly with the airway opened.

Before repositioning patients, it is imperative that you remember to check them for possible spinal injuries. If there is no time to immobilize these injuries and the airway cannot be opened with the victim in the present position, then great care must be taken when repositioning. The head, neck, and back must be moved as a single unit. To do this, adhere to the following four steps (see figure 4-2).

**Step 1—**Kneel to the side of the victim in line with the victim's shoulders, but far enough away so that the victim's body will not touch yours when it is rolled toward you. Straighten the victim's legs, gently but quickly. Then move the victim's closer arm along the floor until it reaches straight out past the head.

**Step 2—**Support the back of the victim's head with one hand while you reach over with the other hand to grasp under the distant armpit.

**Step 3—**Pull the patient toward you while at the same time keeping the head and neck in a natural straight line with the back. Resting the head on the extended arm will help you in this critical task.

**Step 4—**Roll the patient onto his back and reposition the extended arm.

Once the patient is supine with the arms alongside the body, you should position yourself at the patient's side. By positioning yourself at the patient's side, you can more easily assess whether the patient is breathing. If the patient is not breathing, you are already positioned to perform artificial respirations (also referred to as rescue breathing) and chest compressions.

Either one of two maneuvers—the head tilt-chin lift maneuver or the jaw-thrust maneuver—may be used to open an obstructed airway. When performing these maneuvers, you may discover foreign material or vomitus in the mouth that needs to be removed. Do not spend very much time to perform this task. Liquids or semiliquids should be wiped out with the index and middle finger covered by a piece of cloth. Solid material should be extracted with a hooked index finger.

**HEAD TILT-CHIN LIFT MANEUVER**.—The head tilt-chin lift maneuver is the primary method used to open the airway. To perform the head tilt-chin lift maneuver, place one of your hands on the patient's forehead and apply gentle, firm, backward pressure using the palm of your hand. Place the fingers of the other hand under the bony part of the chin. Lift the chin forward and support the jaw, helping to tilt the head back. See figure 4-3. This maneuver will lift the patient's tongue away from the back of the throat and provide an adequate airway.

> **PRECAUTIONS:** When performing the head tilt-chin lift maneuver, do not press too deeply into the soft tissue under the chin. Undue pressure in this location may obstruct the airway. In addition, make sure the mouth is kept open so exhalation and inhalation are not hindered.

**JAW-THRUST MANEUVER**.—The jaw-thrust maneuver is considered an alternate method for opening the airway. This maneuver is accomplished by kneeling near the top of the victim's head, grasping the angles of the patient's lower jaw, and lifting with both hands, one on each side. This will displace the mandible (jawbone) forward while tilting the head backward. Figure 4-4 illustrates the jaw-thrust maneuver. If the lips close, retract the lower lip with your thumb. If mouth-to-mouth breathing is necessary, close the nostrils by placing your cheek tightly against them.

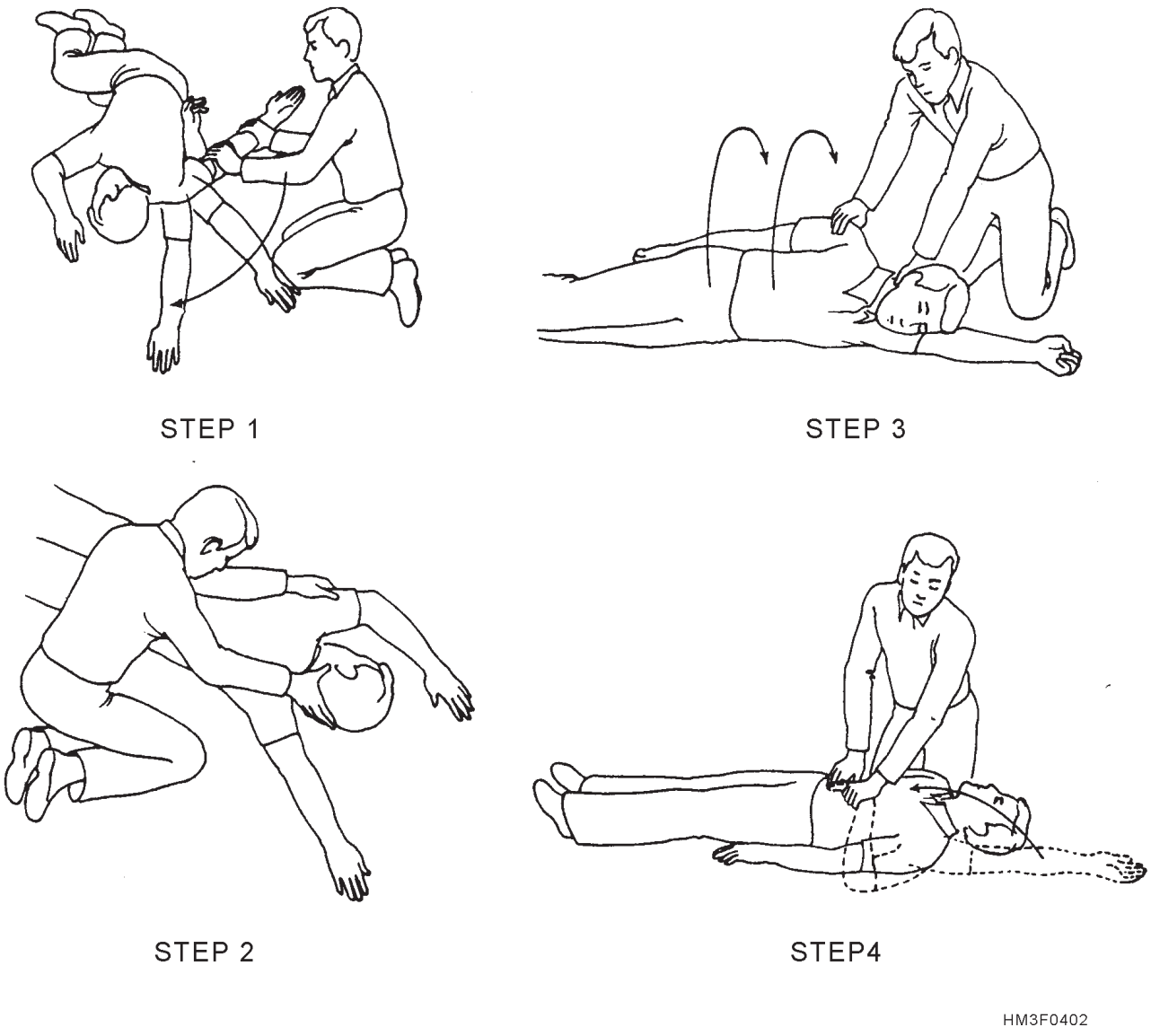


**Figure 4-2.—The four steps to reposition the victims of spinal injuries.**

**NOTE:** The jaw-trust technique without head tilt is considered the safest approach to opening the airway of patients with suspected neck injuries because it usually can be done without extending the neck.

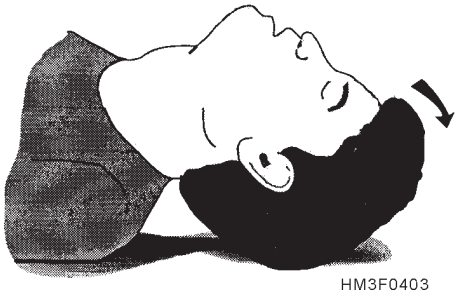


**Figure 4-3.—Head tilt-chin lift maneuver.**

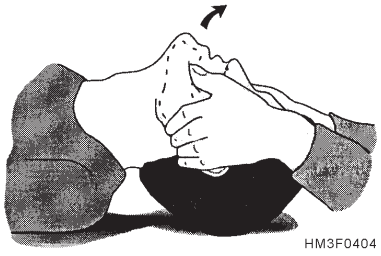


**Figure 4-4.—Jaw-thrust maneuver.**

**Foreign-Body Airway Obstruction Management**

Foreign-body airway obstruction should be considered in any victim—especially a younger victim –who suddenly stops breathing, becomes cyanotic, or loses consciousness for no apparent reason.

The **Heimlich maneuver** (subdiaphragmatic abdominal thrusts) is recommended for relieving foreign-body airway obstruction. By elevating the diaphragm, the Heimlich maneuver can force air from the lungs to create an artificial cough intended to expel a foreign body obstructing the airway. Each individual thrust should be administered with the intent of relieving the obstruction. It may be necessary to repeat the thrust several times to clear the airway. Five thrusts per sequence is recommended.

When you perform this maneuver, you should guard against damage to internal organs, such as rupture or laceration of abdominal or thoracic viscera. To minimize this possibility, your hands should never be placed on the xiphoid process of the sternum or on the lower margins of the rib cage. They should be below this area but above the navel and in the midline.

Regurgitation may occur as a result of abdominal thrusts. Be prepared to position the patient so aspiration does not occur.

**HEIMLICH MANEUVER WITH VICTIM STANDING OR SITTING**.—To perform the Heimlich maneuver with victim standing or sitting, stand behind the victim, wrap your arms around the victim's waist, and proceed as follows:

**Step 1—**Make a fist with one hand.

**Step 2—**Place the thumb side of the fist against the victim's abdomen, in the midline slightly above the navel and well below the tip of the xiphoid process.

**Step 3—**Grasp the fist with the other hand and press the fist into the victim's abdomen with a quick upward thrust. See figure 4-5.

**Step 4—**Repeat the thrusts and continue until the object is expelled from the airway or the patient becomes unconscious. Each new thrust should be a separate and distinct movement.

**HEIMLICH MANEUVER WITH VICTIM LYING DOWN**.—To perform the Heimlich maneuver with victim lying down, proceed as follows:

**Step 1—**Place the victim in the supine position (face up).


**Figure 4-5.—Administering the Heimlich maneuver to a conscious victim who is standing.**

**Step 2—**Kneel astride the victim's thighs and place heel of one hand against the victim's abdomen, in the midline slightly above the navel and well below the tip of the xiphoid.

**Step 3—**Place the second hand directly on top of the first.

**Step 4—**Press into the abdomen with a quick upward thrust. See figure 4-6.


**Figure 4-6.—Administering the Heimlich maneuver to an unconscious victim who is lying down.**

If you are in the correct position, you will have a natural midabdominal position and are unlikely to direct the thrust to the right or left. A rescuer too short to reach around the waist of an unconscious victim can use this technique. The rescuer can use their body weight to perform the maneuver.

**CHEST THRUSTS WITH VICTIM STANDING OR SITTING**.—This technique is used only in the late stages of pregnancy or in the markedly obese victim. To perform chest thrusts with victim standing or sitting, proceed as follows:

**Step 1—**Stand behind the victim, with your arms directly under the victim's armpits, and encircle the victim's chest.

**Step 2—**Place the thumb side of your fist on the middle of the victim's sternum (breastbone), taking care to avoid the xiphoid process and the margins of the rib cage.

**Step 3—**Grab your fist with the other hand and perform backward thrust until the foreign body is expelled or the victim becomes unconscious. See figure 4-7.


**Figure 4-7.—Administering the chest thrust to a conscious victim who is standing.**

**CHEST THRUSTS WITH VICTIM LYING DOWN**.—Chest thrusts should be used only for victims in the late stages of pregnancy and when the Heimlich maneuver cannot be applied effectively to the unconscious, markedly obese victim. To perform chest thrusts with victim lying down, proceed as follows:

**Step 1**—Place the victim on his back and kneel close to the victim's side.

**Step 2—**Place the heel of your hand on the lower portion of the sternum (in the same manner as you would when performing chest compressions).

**Step 3—**Deliver each thrust firmly and distinctly, with the intent of relieving the obstruction.

**MANUAL REMOVAL OF FOREIGN BODY**.—A foreign body can be removed by performing a "finger sweep." This procedure, however, **must be performed on unconscious victims only** (though not on seizure victims). To perform a finger sweep, proceed as follows:

**Step 1—**With the victim's face up, open the victim's mouth by grasping both the tongue and lower jaw between the thumb and fingers and lifting the jaw. This action draws the tongue away from the back of the throat and away from a foreign body that may be lodged there. This step alone may partially relieve the obstruction.

**Step 2—**Insert the index finger of the other hand down along the inside of the cheek and deeply into the throat to the base of the tongue.

**Step 3—**Use a hooking action to dislodge the foreign body and maneuver it into the mouth so that it can be removed. See figure 4-8.


**Figure 4-8.—Finger sweep.**

It is sometimes necessary to use the index finger to push a foreign body against the opposite side of the throat to dislodge and remove it. Be careful not to force the object deeper into the airway. If the foreign body comes within reach, grasp and remove it.

## BREATHING

The second aspect of basic life support is to restore breathing in cases of respiratory arrest. Failure of the breathing mechanism may be caused by various factors. They include complete airway obstruction, insufficient oxygen in the air, inability of the blood to carry oxygen (e.g., carbon monoxide poisoning), paralysis of the breathing center of the brain, and external compression of the body. Respiratory arrest is usually but not always immediately accompanied by cardiac arrest. Periodic checks of the carotid pulse must be made, and you must be prepared to start cardiopulmonary resuscitation (CPR).

Signs of respiratory arrest are an absence of respiratory effort, a lack of detectable air movement through the nose or mouth, unconsciousness, and a cyanotic discoloration of the lips and nail beds.

### Determining Breathlessness

To assess the presence or absence of breathing (fig. 4-9), you should use the following procedures:

**Step 1**—Place your ear over the patient's mouth and nose, while maintaining an open airway.

**Step 2**—While observing the patient's chest,

- **look** for the chest to rise and fall,
- **listen** for air escaping during exhalation, and
- **feel** for the flow of air.

### Recovery Position

If the patient is unresponsive, has no evidence of trauma, and is obviously breathing adequately, place the patient in the "recovery position." See figure 4-10. In the recovery position, the airway is more likely to remain open, and an unrecognized airway obstruction caused by the tongue is less likely to occur. It is important to continue close observation of the patient who has been placed in the recovery position until he becomes responsive.

To place a patient in the recovery position, roll the patient onto his side so that the head, shoulders, and torso move simultaneously without twisting. If the patient has sustained trauma or trauma is suspected, the patient should NOT be moved.

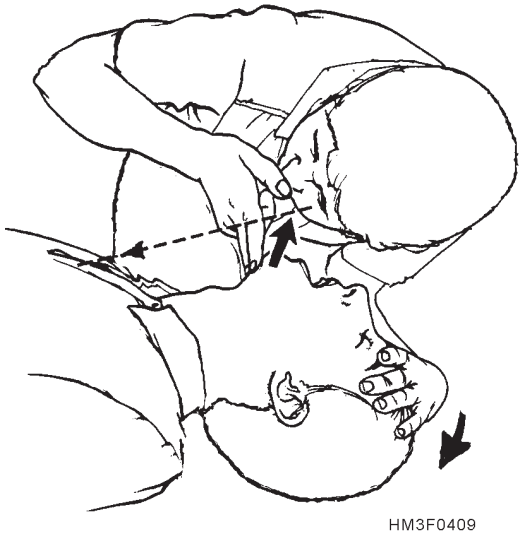


**Figure 4-9.—Determining breathlessness.**

### Artificial Ventilation

If a patient is in respiratory arrest, artificial ventilations must be started immediately. Any delay could result in brain damage or death. The purpose of artificial ventilation is to provide air exchange until natural breathing is re-established. Artificial ventilation should be given only when natural breathing has been suspended; **it must not be given to a person who is breathing naturally**. Do not assume that a person's breathing has stopped merely because the person is unconscious or has been rescued from water, from poisonous gas, or from contact with an electric wire.

Techniques of artificial ventilation include **mouth-to-mouth**, **mouth-to-nose**, **mouth-to-stoma,** and **mouth-to-mask**. These techniques as they apply to adult patients are discussed in the following sections.

**MOUTH-TO-MOUTH**.—Artificial ventilation with the mouth-to-mouth technique is a quick, effective way to provide oxygen to the patient. The exhaled air contains enough oxygen to supply the patient's needs.

To perform mouth-to-mouth ventilation, the airway must be open. To open the airway, perform the head tilt-chin lift or jaw-thrust maneuver. If there is no spontaneous breathing, start artificial ventilation by pinching the nose closed with your thumb and index

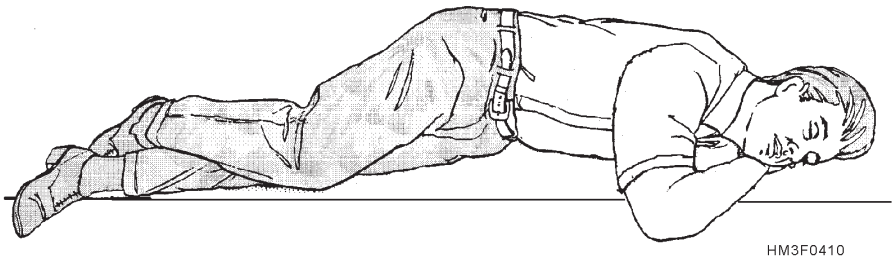


**Figure 4-10.—A patient in the recovery position.**

finger. Take a deep breath and seat your lips around the patient's mouth (creating an airtight seal), and give two slow ventilations (1 ½ to 2 seconds per breath). See figure 4-11. Allow enough time for the lungs to deflate between ventilations. If the patient still does not respond, continue mouth-to-mouth ventilations at the rate of 10 to 12 ventilations per minute or one breath every 5 seconds. Periodically, check the pupils for reaction to light; constriction is a sign of adequate oxygenation.

> **NOTE:** When performing artificial ventilation and the lungs cannot be inflated adequately, repeat head tilt-chin lift or jaw-thrust maneuver, and again attempt ventilation. If the lungs still do not inflate adequately, assume the airway is obstructed by a foreign object.

**MOUTH-TO-NOSE**.—Mouth-to-nose ventilation is effective when the patient's mouth cannot be opened (lockjaw), extensive facial or dental injuries occur, or an airtight seal of the mouth cannot be achieved. Figure 4-12 shows an example of this procedure.

To administer this technique, tilt the head back with one hand on the patient's forehead and use the other hand to lift the jaw (as in the head tilt-chin lift maneuver). Close the victim's mouth. Take a deep breath, seal your lips around the patient's nose, and give two ventilations. Allow the victim's lungs to deflate passively after each ventilation. If the victim does not respond, then you must fully inflate the lungs at the rate of 10 to 12 ventilations per minute or one breath every 5 seconds until the victim can breathe spontaneously.

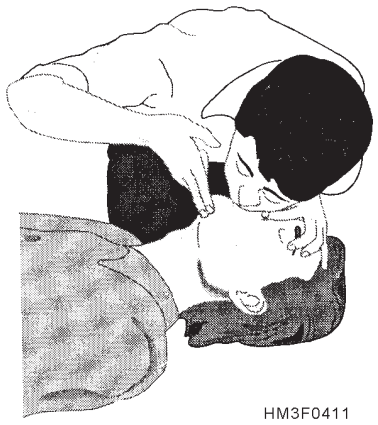


**Figure 4-11.—Mouth-to-mouth ventilation.**


**Figure 4-12.—Mouth-to-nose ventilation.**

**MOUTH-TO-STOMA.—**A casualty who has had surgery to remove part of the windpipe will breathe through an opening in the front of the neck called a **stoma**. Cover the casualty's mouth with your hand, take a deep breath, and seal your mouth over the stoma. Breathe slowly, using the procedures for mouth-to-mouth breathing. **Do not tilt the head back.** (In some situations, a person may breathe through the stoma as well as his nose and mouth. If the casualty's chest does not rise, cover his mouth and nose, and continue breathing through the stoma.)

**MOUTH-TO-MASK**.—The mouth-to-mask breathing device includes a transparent mask with a one-way valve mouth piece. The one-way valve directs the rescuer's breath into the patient's airway while diverting the patients's exhaled air away from the rescuer. Some devices have an oxygen adaptor that permits the administration of supplemental oxygen.

Mouth-to-mask is a reliable form of ventilation since it allows the rescuer to use two hands to create a seal. Follow the steps below to perform the mouth-to-mask technique.

**Step 1—**Place the mask around the patient's mouth and nose, using the bridge of the nose as a guide for correct position. Proper positioning of the mask is critical because gaps between the mask and the face will result in air leakage.

**Step 2—**Seal the mask by placing the heel and thumb of each hand along the border of the mask and compressing firmly to provide a tight seal around the margin of the mask.

**Step 3—**Place your remaining fingers along the bony margin of the jaw and lift the jaw while performing a head tilt.

**Step 4**—Give breaths in the same sequence and at the same rate as in mouth-to-mouth resuscitation; observe the chest for expansion.

### Gastric Distention

Sometimes during artificial ventilation, air is forced into the stomach instead of into the lungs. The stomach becomes distended (bulges), indicating that the airway is blocked or partially blocked, or that ventilations are too forceful. This problem is more common in children but can occur with adults as well. A slight bulge is of little worry, but a major distention can cause two serious problems. First, it reduces lung volume: the distended stomach forces the diaphragm up. Second, there is a strong possibility of vomiting.

The best way to avoid gastric distention is to position the head and neck properly and/or limit the volume of ventilations delivered.

> **NOTE:** THE AMERICAN RED CROSS (ARC) STATES THAT NO ATTEMPT SHOULD BE MADE TO FORCE AIR FROM THE STOMACH UNLESS SUCTION EQUIP- MENT IS ON HAND FOR IMMEDIATE USE.

If suction equipment is ready and the patient has a marked distention, you can turn the patient on his side facing away from you. With the flat of your hand, apply gentle pressure between the navel and the rib cage. Be prepared to use suction should vomiting occur.

## CIRCULATION

Cardiac arrest is the complete stoppage of heart function. If the patient is to live, action must be taken immediately to restore heart function. The symptoms of cardiac arrest include absence of carotid pulse, lack of heartbeat, dilated pupils, and absence of breathing.

A rescuer knowing how to administer cardiopulmonary resuscitation (CPR) greatly increases the chances of a victim's survival. CPR consists of external heart compression and artificial ventilation. External heart compression is performed on the outside of the chest, and the lungs are ventilated by the mouth-to-mouth, mouth-to-nose, mouth-to-stoma, or mouth-to-mask techniques. To be effective, CPR must be started within 4 minutes of the onset of cardiac arrest. The victim should be supine on a firm surface.

CPR should not be attempted by a rescuer who has not been properly trained. If improperly done, CPR can cause serious damage. It must never be practiced on a healthy individual. For training purposes, use a training aid instead. To learn this technique, see your medical education department or an American Heart Association- or American Red Cross-certified Hospital Corpsman, nurse, or physician.

### One-Rescuer CPR

The rescuer must not assume that a cardiac arrest has occurred solely because the victim is lying on the floor and appears to be unconscious. First, try to rouse the victim by gently shaking the shoulders and trying to obtain a response (e.g., loudly ask: "Are you OK?"). If there is no response, place the victim supine on a firm surface. **Always assume neck injuries in unconscious patients.** Kneel at a right angle to the victim, and open the airway using the head tilt-chin lift or jaw-thrust methods described previously. Attempt to ventilate. If unsuccessful, reposition the head and again attempt to ventilate. If still unsuccessful, deliver five abdominal thrusts (Heimlich maneuver) or chest thrusts to open the airway. Repeat the thrust sequence until the obstruction is removed.

**DETERMINING PULSELESSNESS**.—Once the airway has been opened, check for the carotid pulse. The carotid artery is most easily found by locating the larynx at the front of the neck and then sliding two fingers down the side of the neck toward you (fig. 4-13). The carotid pulse is felt in the groove between the larynx and the sternocleidomastoid

muscle. If the pulse is present, ventilate as necessary. If the pulse is absent, locate the sternum and begin chest compressions.

**PROPER POSITIONING OF HANDS ON STERNUM**.—To locate the sternum, use the middle and index fingers of your lower hand to locate the lower margin of the victim's rib cage on the side closest to you (fig. 4-14). Then move your fingers up along the edge of the rib cage to the notch where the ribs meet the sternum in the center of the lower chest. Place your middle finger on the notch and your index finger next to it. Place the heel of your other hand along the midline of the sternum next to your index finger. Remember to keep the heel of your hand off the xiphoid (tip of the sternum). A fracture in this area may damage the liver, causing hemorrhage and death.

**CHEST COMPRESSIONS**.—Place the heel of one hand directly on the sternum and the heel of the other on top of the first. Interlock your fingers or extend them straight out and **KEEP THEM OFF THE VICTIM'S CHEST!** Effective compression is accomplished by locking your elbows into position, straightening your arms, and positioning your shoulders directly over hands so that the thrust for each chest compression is straight down on the sternum. See figure 4-15. The sternum should be depressed approximately 1 ½ to 2 inches (for adults). Release chest compression pressure between each compression to allow blood to flow into the chest and heart. When releasing chest compression pressure, remember to keep your hands in place on the chest.

Not only will you feel less fatigue if you use the proper technique, but a more effective compression


**Figure 4-14.—Proper position of hands on the sternum for chest compressions.**

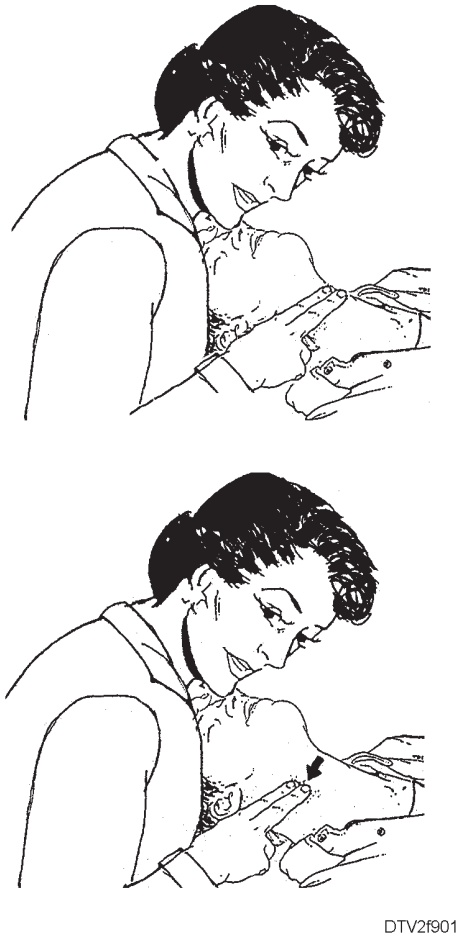


**Figure 4-13.—Locating the carotid pulse.**

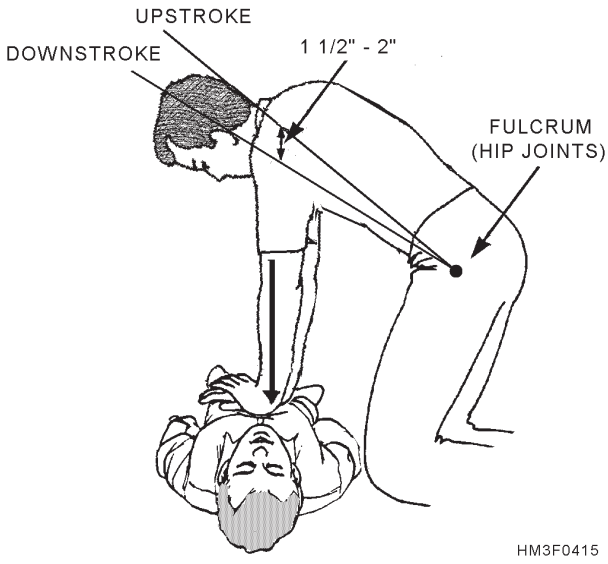


**Figure 4-15.—Proper position of the rescuer.**

will also result. Ineffective compression occurs when the elbows are not locked, the rescuer is not directly over the sternum, or the hands are improperly placed on the sternum.

**PERFORMANCE AND REASSESSMENT OF CPR**.—When one rescuer performs CPR, the ratio of compressions to ventilations is 15 to 2, and it is performed at a rate of 80 to 100 compressions per minute. Vocalize: "one and, two and, three and,..." until you reach 15. After 15 compressions, you must give the victim two slow ventilations (1 ½ to 2 seconds). Continue for four full cycles. Quickly check for the carotid pulse and spontaneous breathing. If there are still no signs of recovery, continue CPR with compressions. Reassess the patient every few minutes thereafter.

If a periodic check reveals a return of pulse and respiration, discontinue CPR and place the victim in the recovery position. Continue monitoring the victim and be prepared to restart CPR .

**Two-Rescuer CPR**

If there are two people trained in CPR on the scene, one should perform chest compressions while the other performs ventilations. The compression rate for two-rescuer CPR is the same as it is for one-rescuer CPR: 80 to 100 compressions per minute. However, the compression-ventilation ratio is 5 to 1, with a pause for ventilation of 1 ½ to 2 seconds consisting primarily of inspiration. Exhalation occurs during chest compressions.

Two-rescuer CPR should be performed with one rescuer positioned at the chest area and the other positioned beside the victim's head. The rescuers should be on opposite sides of the victim to ease position changes when one rescuer gets tired. Changes should be made on cue without interrupting the rhythm.

The victim's condition must be monitored to assess the effectiveness of the rescue effort. The person ventilating the patient assumes the responsibility for monitoring pulse and breathing. To assess the effectiveness of the partner's chest compressions, the rescuer should check the pulse during compressions. To determine if the victim has resumed spontaneous breathing and circulation, chest compressions must be stopped for 5 seconds at the end of the first minute (20 cycles) and every few minutes thereafter.

**NOTE**: Although it has fallen out to favor with some agencies, two-person CPR remains a viable method of resuscitation.

**CPR for Children and Infants**

CPR for children (1 to 8 years old) is similar to that for adults. The primary differences are that the heel of only one hand is used to apply chest compressions, and ventilations are increased to a rate of 20 breaths per minute (once every 3 seconds). Chest compressions are performed on the lower half of the sternum (between the nipple line and the notch). The chest should be depressed approximately one-third to one-half (about 1 to 1 ½ inches) the total depth of the chest.

For infants (under 1 year old), CPR is performed with the infant supine on a hard, flat surface. The hard surface may be the rescuer's hand or arm, although using the arm to support the infant during CPR enables the rescuer to transport the infant more easily while continuing CPR. See figure 4-16. Once the infant is positioned on a hard surface, the airway should be opened using the head tilt-chin lift or jaw-thrust maneuver. Both maneuvers, however, must be performed very carefully and gently to prevent hyperextension of the infant's neck. Pulselessness is determined by palpating the brachial artery (fig. 4-17). If the infant has no pulse and is not breathing, CPR must be started immediately.

To perform CPR on an infant, place your mouth over the infant's nose and mouth, creating a seal. Give two slow breaths (1 to 1 ½ seconds per breath) to the infant, pausing after the first breath to take a breath. Pausing to take a breath after the first breath of each pair of breaths maximizes oxygen content and

**Figure 4-16.—Infant supported on rescuer's arm, and proper placement of fingers for chest compressions.**


**Figure 4-17.—Palpating brachial artery pulse in an infant.**

minimizes carbon dioxide concentration in the delivered breaths. Perform chest compressions by using two fingers to depress the middle of the sternum approximately ½ to 1 inch. See figures 4-16 and 4-18 for proper finger positioning for chest compressions.

For both infants and children, the compression rate should be at least 100 compressions per minute. Compressions must be coordinated with ventilations at a 5-to-1 ratio. The victim should be reassessed after 20 cycles of compressions and ventilations (approximately 1 minute) and every few minutes thereafter for any sign of resumption of spontaneous breathing and pulse. If the child or infant resumes effective breathing, place the victim in the recovery position.

## SHOCK

**LEARNING OBJECTIVE:** *Recognize the signs and symptoms of shock, and determine treatment by the type of shock presented.*

Shock is the collapse of the cardiovascular system, characterized by circulatory deficiency and the depression of vital functions. There are several types of shock:

- **Hypovolemic shock**–caused by the loss of blood and other body fluids.
- **Neurogenic shock**–caused by the failure of the nervous system to control the diameter of blood vessels.

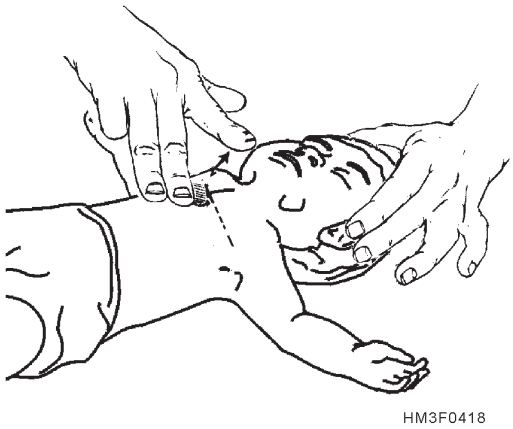


**Figure 4-18.—Locating proper finger position to perform chest compressions in infants.**

- **Cardiogenic shock**–caused by the heart failing to pump blood adequately to all vital parts of the body.
- **Septic shock**–caused by the presence of severe infection.
- **Anaphylactic shock**–caused by a life-threatening reaction of the body to a substance to which a patient is extremely allergic.

Multiple types of shock may be present in varying degrees in the same patient at the same time. The most frequently encountered and most important type for the Hospital Corpsman to understand is **hemorrhagic shock**, a type of hypovolemic shock which will be discussed later in this chapter.

Shock should be expected in all cases of major injury, including gross hemorrhage, abdominal or chest wounds, crash or blast injuries, extensive large-muscle damage (particularly of the extremities), major fractures, traumatic amputations, or head injuries, or in burns involving more than 10 percent of the body surface area.

### SYMPTOMS OF SHOCK

The symptoms of shock vary from patient to patient and even within an individual during the course of illness. Evaluation of the whole situation is more important than one particular sign or symptom.

#### Degrees of Shock

Table 4-2 provides a generalized overview of the degrees of shock and their symptoms correlated to the approximate volume deficit.

**Table 4-2.—Correlation of Magnitude of Volume Deficit and Clinical Presentation**

| Approximate Deficit (ml) | Decrease in Blood Volume % | Degree | Signs |
|---|---|---|---|
| 0-500 | 0-10 | None | None |
| 500-1200 | 10-25 | Mild | Slight tachycardia<br>Postural changes in blood pressure<br>Mild peripheral vasoconstriction<br>Increased respirations |
| 1200-1800 | 25-35 | Moderate | Thready pulse 100-120<br>Systolic blood pressure 90-100<br>Marked vasoconstriction<br>Labored breathing<br>Diaphoresis (profuse perspiration)<br>Anxiety and restlessness<br>Decreased urine output |
| 1800-2500 | 35-50 | Severe | Thready pulse > 120<br>Systolic blood pressure < 60<br>Weakened respirations<br>Increased diaphoresis<br>Changes in levels of consciousness<br>No urine output |

**Shock Control and Prevention**

The essence of shock control and prevention is to recognize the onset of the condition and to start treatment before the symptoms fully develop. The following are general signs and symptoms of the development of shock (see figure 4-19):

- Restlessness and apprehension are early symptoms, often followed by apathy.
- Eyes may be glassy and dull. Pupils may be dilated. (These are also the symptoms of morphine use.)
- Breathing may be rapid or labored, often of the gasping, "air hunger" type. In the advanced stages of shock, breathing becomes shallow and irregular.
- The face and skin may be very pale or ashen gray; in the dark complexioned, the mucous membranes may be pale. The lips are often cyanotic.
- The skin feels cool and is covered with clammy sweat. The skin's coolness is related to a decrease in the peripheral circulation.
- The pulse tends to become rapid, weak, and thready. If the blood pressure is severely lowered, the peripheral pulse may be absent. The pulse rate in hemorrhagic shock may reach 140 or higher. In neurogenic shock, however, the pulse rate is slowed, often below 60.
- The blood pressure is usually lowered in moderately severe shock; the systolic pressure drops below 100, while the pulse rises above 100. The body is compensating for circulatory fluid loss by peripheral vasoconstriction. This process tends to maintain the blood pressure at a nearly normal level despite a moderately severe loss of circulating blood volume. A point comes, however, when decompensation occurs, and a small amount of additional blood loss will produce a sudden, alarming fall in blood pressure.
- There may be nausea, vomiting, and dryness of the mouth, lips, and tongue.
- Surface veins may collapse. Veins normally visible at the front of the elbow, forearms,

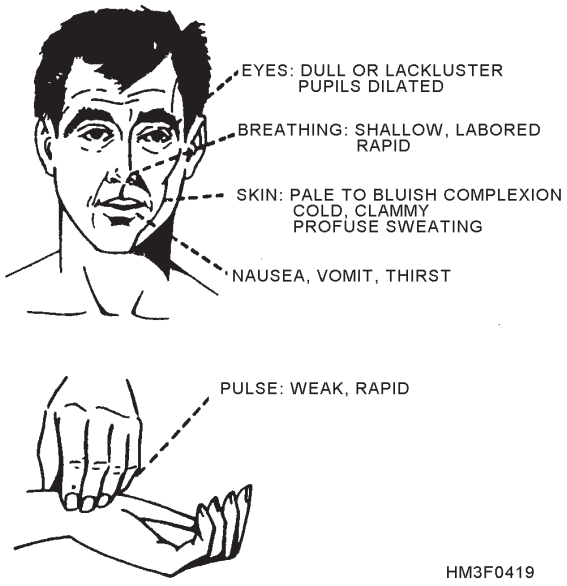


**Figure 4-19.—Symptoms of shock.**

and the back of the hands will be hard to distinguish.

- There are frequent complaints of thirst. Even the severely wounded may complain of thirst rather than pain.
- The kidneys may shut down. Urine formation either ceases or greatly diminishes if the systolic blood pressure falls below 80 for long periods of time.
- The person may faint from inadequate venous blood return to the heart. This may be the result of a temporary gravitational pooling of the blood associated with standing up too quickly.

## HYPOVOLEMIC SHOCK

Hypovolemic shock is also known as oligemic or hematogenic shock. The essential feature of all forms of hypovolemic shock is loss of fluid from the circulating blood volume, so that adequate circulation to all parts of the body cannot be maintained.

### Hemorrhagic Shock

In cases where there is internal or external hemorrhage due to trauma (hemorrhagic shock), there is a loss of whole blood, including red blood cells. The diminished blood volume causes a markedly lessened cardiac output and reduced peripheral circulation. This results in reduction of oxygen transported to the tissues (hypoxia); reduction of perfusion, the circulation of blood within an organ; and reduction of waste products transported away from the tissue cells. Under these conditions, body cells are able to carry on their normal functions for only a short period of time. The body tries to restore the circulatory volume by supplying fluid from the body tissues. The result is a progressive fall in the hematocrit (ratio of red blood cells to plasma) and in the red blood cell count.

### Burn Shock

In burn shock, on the other hand, there is a progressive increase in the hematocrit and red blood cell count. This increase is due to hemoconcentration from loss of the plasma fraction of the blood into and through the burned area.

## NEUROGENIC SHOCK

Neurogenic shock, sometimes called vasogenic shock, results from the disruption of autonomic nervous system control over vasoconstriction. Under normal conditions, the autonomic nervous system keeps the muscles of the veins and arteries partially contracted. At the onset of most forms of shock, further constriction is signaled. However, the vascular muscles cannot maintain this contraction indefinitely. A number of factors, including increased fluid loss, central nervous system trauma, or emotional shock, can override the autonomic nervous system control. The veins and arteries immediately dilate, drastically expanding the volume of the circulatory system, with a corresponding reduction of blood pressure.

Simple fainting (syncope) is a variation of neurogenic shock. It often is the result of a temporary gravitational pooling of the blood as a person stands up. As the person falls, blood again rushes to the head, and the problem is solved. Neurogenic shock may also be induced by fear or horror, which will override the autonomic nervous system control.

Shell shock and bomb shock are other variations of neurogenic shock that are important to the Hospital Corpsman. These are psychological adjustment reactions to extremely stressful wartime experiences and do not relate to the collapse of the cardiovascular system. Symptoms range from intense fear to complete dementia and are manifestations of a loss of nervous control. Care is limited to emotional support of the patient and his evacuation to the care of a psychiatrist or psychologist.

## CARDIOGENIC SHOCK

Cardiogenic shock is caused by inadequate functioning of the heart, not by loss of circulating blood volume. If the heart muscle is weakened by disease or damaged by trauma or lack of oxygen (as in cases of pulmonary disease, suffocation, or myocardial infarction), the heart will no longer be able to maintain adequate circulatory pressure, even though the volume of fluid is unchanged. Shock will develop as the pressure falls. Heart attack is an extreme medical emergency all Hospital Corpsmen must be ready to handle. It will be discussed in greater detail in the "Common Medical Emergencies" section of this chapter.

## SEPTIC SHOCK

Septic shock usually does not develop for 2 to 5 days after an injury and the patient is not often seen by the Corpsman in a first aid situation. Septic shock may appear during the course of peritonitis caused by penetrating abdominal wounds or perforation of the appendix. Gross wound contamination, rupture of an ulcer, or complications from certain types of pneumonia may also cause septic shock. Septic shock is the result of vasodilation of small blood vessels in the wound area, or general vasodilation if the infection enters the bloodstream. In addition to increasing circulatory system volume, the walls of the blood vessels become more permeable, which allows fluids to escape into the tissues. This type of shock carries a poor prognosis and should be treated under the direct supervision of a medical officer.

## ANAPHYLACTIC SHOCK

Anaphylactic shock occurs when an individual is exposed to a substance to which his body is particularly sensitive. In the most severe form of anaphylactic shock, the body goes into an almost instantaneous violent reaction. A burning sensation, itching, and hives spread across the skin. Severe edema affects body parts and the respiratory system. Blood pressure drops alarmingly, and fainting or coma may occur.

The causative agent may be introduced into the body in a number of ways. The injection of medicines (especially penicillin and horse- or egg-cultured serums) is one route. Another method is the injection of venoms by stinging insects and animals. The inhalation of dusts, pollens, or other materials to which a person is sensitive is a third route. Finally, a slightly slower but no less severe reaction may develop from the ingestion of certain foods and medications. Specific treatment of venoms and poisons will be discussed in chapter 5, "Poisoning, Drug Abuse, and Hazardous Material Exposure."

## GENERAL TREATMENT PROCEDURES

Intravenous fluid administration is the most important factor in the treatment of all types of shock except cardiogenic shock. Ringer's lactate is the best solution to use, although normal saline is adequate until properly cross-matched whole blood can be administered. The electrolyte solutions replace not only the lost blood volume, but also lost extracellular fluid that has been depleted. If the shock is severe enough to warrant immediate administration of intravenous fluids, or if transportation to a medical facility will be delayed and a medical officer is not available to write an administrative order, be conservative: Start the intravenous fluids and let them run at a slow rate of 50 to 60 drops per minute. If intravenous solutions are unavailable or transportation to a medical treatment facility will be delayed, and there are no contraindications (such as gastrointestinal bleeding or unconsciousness), you may give the patient an electrolyte solution by mouth. An electrolyte solution may be prepared by adding a teaspoon of salt and half a teaspoon of baking soda to a quart or liter of water. Allow the patient to sip the solution.

Other treatment procedures for shock are as follows:

- Maintain an open airway. Oxygen may also be administered if proper equipment is available.
- Control hemorrhages.
- Check for other injuries that may have been sustained. Remove the victim from the presence of identifiable causative agents.
- Place the victim in a supine position, with the feet slightly higher than the head (shock position). Certain problems, such as breathing difficulties or head injuries, may require other positioning.
- Reduce pain by splinting fractures, providing emotional support, and attending to the victim's comfort. Unless contraindicated, aspirin may be dispensed.
- Conserve the patient's body heat.

- Avoid rough handling of the victim, and transport to a medical treatment facility.
- If transportation to a definitive care facility will be lengthy or delayed, seek the radio or phone advice of a medical officer on whether to give fluids by mouth or to start an intravenous line. If this consultation is impossible, use your own judgment. In the case of cardiogenic shock, DO NOT start intravenous fluids since blood volume is sufficient and only function is impaired.
- Constantly monitor the patient and record vital signs every 15 minutes so that you are able to keep track of the patient's progress.

## PNEUMATIC COUNTER-PRESSURE DEVICES (MAST)

Commonly known as Medical Anti-Shock Trousers or Military Anti-Shock Trousers (MAST), pneumatic counter-pressure devices are designed to correct or counteract certain internal bleeding conditions and hypovolemia. The garment does this by developing an encircling pressure up to 120 mm Hg around both lower extremities, the pelvis, and the abdomen. The pressure created

- slows or stops venous and arterial bleeding in areas of the body enclosed by the pressurized garment;
- forces available blood from the lower body to the heart, brain, and other vital organs;
- prevents pooling of blood in the lower extremities; and
- stabilizes fractures of the pelvis and lower extremities.

Some indications for use of the pneumatic counter-pressure devices are when

- systolic blood pressure is less than 80 mm Hg,
- systolic blood pressure is less than 100 mm Hg and the patient exhibits the classic signs of shock, or
- fracture of the pelvis or lower extremities is present.

Although the only absolute contraindication in the use of these devices is in the case of pulmonary edema, other conditional contraindications include congestive heart failure, heart attack, stroke, pregnancy, abdominal evisceration, massive bleeding into the thoracic cavity, and penetrating wounds where the object is still impaled in the victim.

Application of the anti-shock garment is a simple procedure, but it requires some important preliminary steps. When the garment is laid out flat, ensure that there are no wrinkles. If the patient is to remain clothed, remove all sharp and bulky objects from the patient's pockets. Take vital signs before applying the MAST garment. When applying the garment, inflate sufficiently so the patient's systolic blood pressure is brought to and maintained at 100 mm Hg. Once the garment is inflated, take the patient's vital signs every 5 minutes. The garment should be removed only under the direct supervision of a physician.

## BREATHING AIDS

**LEARNING OBJECTIVE:** *Recognize breathing aids and their uses.*

As a Hospital Corpsman, you should become familiar with the breathing aids that may be available to help you maintain an open airway and to restore breathing in emergency situations. Breathing aids include oxygen, artificial airways, bag-valve mask ventilator, pocket face mask, and suction devices.

## USE OF OXYGEN ($O_2$)

In an emergency situation, you will probably have a size E, 650-liter cylinder of oxygen available. The oxygen cylinder is usually fitted with a yoke-style pressure-reducing regulator, with gauges to show tank pressure and flow rate (adjustable from 0 to 15 liters per minute). A humidifier can be attached to the flowmeter nipple to help prevent tissue drying caused by the water-vapor-free oxygen. An oxygen line can be connected from the flowmeter nipple or humidifier to a number of oxygen delivery devices that will be discussed later.

When available, oxygen should be administered, as described below, to cardiac arrest patients and to self-ventilating patients who are unable to inhale enough oxygen to prevent **hypoxia** (oxygen deficiency). Hypoxia is characterized by tachycardia, nervousness, irritability, and finally cyanosis. It develops in a wide range of situations, including poisoning, shock, crushing chest injuries, cerebrospinal accidents, and heart attacks.

Oxygen must never be used near open flames since it supports burning. Oxygen cylinders must be handled carefully since they are potentially lethal missiles if punctured or broken.

## ARTIFICIAL AIRWAYS

The oropharyngeal and nasopharyngeal airways are primarily used to keep the tongue from occluding (closing) the airway.

### Oropharyngeal Airway

The oropharyngeal airway can be used only on unconscious victims because a conscious person will gag on it. This airway comes in various sizes for different age groups and is shaped to rest on the contour of the tongue and extend from the lips to the pharynx. Selecting the correct size oropharyngeal airway is very important to its effectiveness. An airway of proper size will extend from the corner of the patient's mouth to the tip of the earlobe on the same side of the patient's face.

One method of insertion is to depress the tongue with a tongue blade and slide the airway in. Another method is to insert the airway upside down into the victim's mouth; then rotate it 180° as it slides into the pharynx (fig. 4-20).

### Nasopharyngeal Airway

The nasopharyngeal airway may be used on conscious victims since it is better tolerated because it generally does not stimulate the gag reflex. Since it is made of flexible material, it is designed to be lubricated and then gently passed up the nostril and down into the pharynx. If the airway meets an obstruction in one nostril, withdraw it and try to pass it up the other nostril. See figure 4-21 for proper insertion of the nasopharyngeal airway.


**Figure 4-20.—The rotation method of inserting an oropharyngeal airway.**

## BAG-VALVE MASK VENTILATOR

The bag-valve mask ventilator (fig. 4-22) is designed to help ventilate an unconscious victim for long periods while delivering high concentrations of oxygen. This system can be useful in extended CPR attempts because, when using external cardiac compressions, the cardiac output is cut to 25 to 30 percent of the normal capacity, and artificial ventilation does not supply enough oxygen through the circulatory system to maintain life for a long period.

Various types of bag-valve-mask systems that come in both adult and pediatric sizes are in use in the Navy. Essentially, they consist of a self-filling ventilation bag, an oxygen reservoir, plastic face masks of various sizes, and tubing for connecting to an oxygen supply.

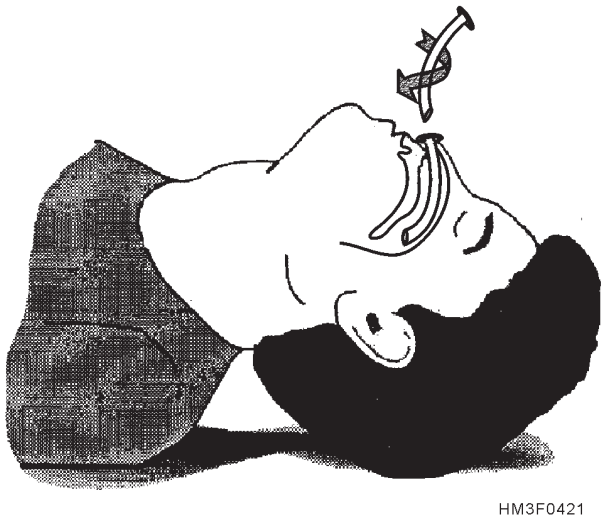


**Figure 4-21.—Proper insertion of a nasopharyngeal airway.**

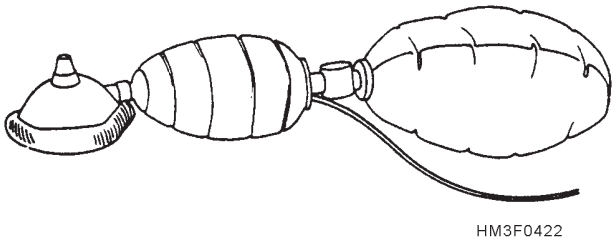


**Figure 4-22.—Bag-valve mask ventilator.**

### Limitations of the Bag-Valve Mask Ventilator

The bag-valve mask ventilator is difficult to use unless the user has had sufficient practice with it. It must not be used by inexperienced individuals. The system can be hard to clean and reassemble properly; the bagging hand can tire easily; and an airtight seal at the face is hard to maintain, especially if a single rescuer must also keep the airway open. In addition, the amount of air delivered to the victim is limited to the volume that the hand can displace from the bag (approximately 1 liter per compression).

### Procedures for Operating the Bag-Valve Mask Ventilator

To use the bag-valve mask ventilator, hook the bag up to an oxygen supply and adjust the flow in the range of 10 to 15 liters per minute, depending on the desired concentration (15 liters per minute will deliver an oxygen concentration of 90 percent). After opening the airway or inserting an oropharyngeal airway, place the mask over the face and hold it firmly in position with the index finger and thumb, while keeping the jaw tilted upward with the remaining fingers (fig. 4-23). Use the other hand to compress the bag once every 5 seconds. Observe the chest for expansion. If none is observed, the face mask seal may not be airtight, the airway may be blocked, or some component of the bag-valve mask ventilator may be malfunctioning.

## POCKET FACE MASK

A pocket face mask designed with an oxygen-inlet flow valve for mouth-to-mask ventilation can be used to give oxygen-enriched artificial ventilation. Although a pocket face mask system cannot achieve oxygen concentrations as high as the bag-valve mask system, it has the advantages of providing greater air volume (up to 4 liters per breath) and of being much easier to use (since both hands are free to maintain the airway and keep the mask firmly in place). See figure 4-24. The pocket face mask also acts as a barrier device. It prevents the rescuer from coming in contact with the patient's body fluids and breath, which are possible sources of infection.

To use the pocket face mask, stand behind the head of the victim, and open the airway by tilting the head backward. Place the mask over the victim's face (for adults, the apex goes over the bridge of the nose; for infants, the apex fits over the chin, with the base resting on the bridge of the nose). Form an airtight seal between the mask and the face, and keep the airway open by pressing down on the mask with both thumbs while using the other fingers to lift the jaw up and back. Ventilate into the open chimney of the mask.

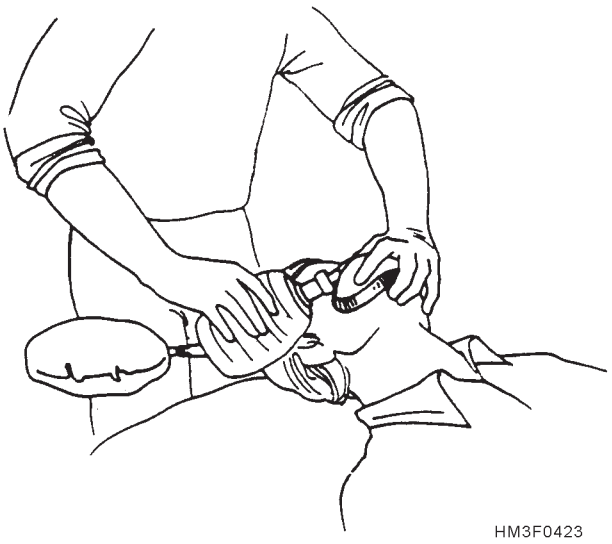


**Figure 4-23.—Bag-valve mask ventilator in use.**


**Figure 4-24.—Providing mouth-to-mask ventilations with pocket face mask.**

Oxygen can be added by hooking the valve up to an oxygen supply. Since the rescuer's breath dilutes the oxygen flow in artificial ventilation, adjust the flow rate to increase oxygen concentration. At 5 liters per minute, the oxygen concentration will be approximately 50 percent. At 15 liters per minute, this concentration will increase to 55 percent.

The mask has an elastic strap so it can be used on conscious, self-ventilating patients to increase oxygen concentration.

## SUCTION DEVICES

The patient's airway must be kept clear of foreign materials, blood, vomitus, and other secretions. Materials that remain in the airway may be forced into the trachea and eventually into the lungs. This will cause complications ranging from severe pneumonia to a complete airway obstruction. Use suction to remove such materials.

In the field, a Hospital Corpsman may have access to a fixed (installed) suction unit or a portable suction device. Both types of suction devices are equipped with flexible tubing, suction tips and catheters, and a non-breakable collection container.

Maintenance of suction devices consists of testing the suction pressure regularly and cleaning the device after each use.

Before using a suction device, always test the apparatus. Once the suction pressure has been tested, attach a suction catheter or tip. Position the patient on his side, and open the patient's mouth. This position permits secretions to flow from the patient's mouth while suction is being delivered. Use caution in patients with suspected neck or spinal injuries. If the patient is fully and securely immobilized on a backboard, the backboard may be tilted to place the patient on his side. If you suspect such injuries but the patient is not immobilized, suction as best you can without turning the patient. Carefully insert the suction tip or catheter at the top of the throat (fig. 4-25). DO NOT push the tip down into the throat or into the larynx. Apply suction, but for no more than a few seconds, since supplemental oxygen or ventilations cease while suctioning, keeping oxygen from the patient. Suction may be repeated after a few breaths.

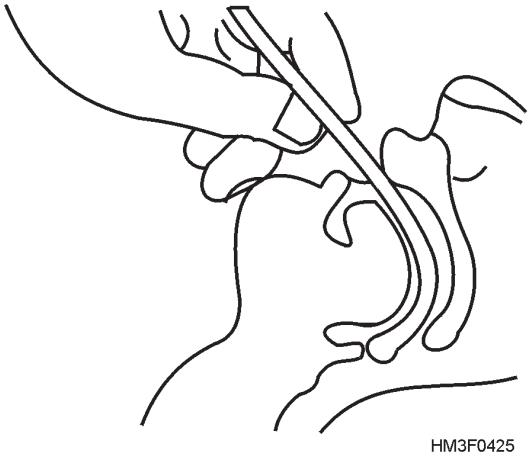


**Figure 4-25.—Proper insertion of suction tip.**

## CRICOTHYROIDOTOMY

A cricothyroidotomy, often called an emergency tracheotomy, consists of incising the cricothyroid membrane, which lies just beneath the skin between the thyroid cartilage and the cricoid cartilage. In most cases, the cricothyroid membrane can be easily located by hyperextending the neck so that the thyroid notch (Adam's apple) becomes prominent anteriorly. Identify the position of the thyroid notch with the index finger. This finger descends in the midline to the prominence of the cricoid cartilage. The depression of the cricothyroid membrane is identified above the superior margin of the cricoid cartilage (fig. 4-26). Make a small lateral incision at the base of the thyroid cartilage to expose the cricothyroid membrane. Excise this membrane (taking care not to go too deeply) and insert a small-bore air line into the trachea.

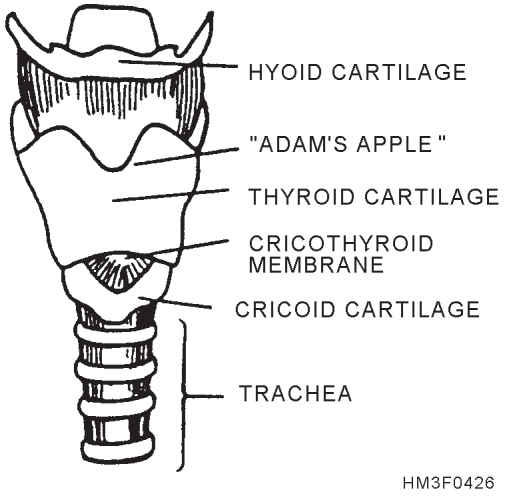


**Figure 4-26.—Anatomical structures of the neck to identify the cricothyroid membrane.**

An alternate method is to use a 12- to 16-gauge intercatheter. Locate the cricothyroid membrane as described above and insert the needle into the trachea. Immediately upon penetration of the cricothyroid membrane, thread the plastic catheter into the trachea and remove the needle. Then connect the catheter to an oxygen line for translaryngeal oxygen jet insufflation.

**Do not attempt a cricothyroidotomy except as a last resort when other methods of opening the airway have been unsuccessful.**

## SOFT TISSUE INJURIES

**LEARNING OBJECTIVE:** *Recognize the different types of wounds, and determine management and treatment procedures for open and internal soft-tissue injuries.*

The most common injuries seen by the Corpsman in a first aid setting are soft tissue injuries with the accompanying hemorrhage, shock, and danger of infection. Any injury that causes a break in the skin, underlying soft tissue structures, or body membranes is known as a **wound**. This section will discuss the classification of wounds, the general and specific treatment of soft tissue injuries, the use of dressings and bandages in treating wounds, and the special problems that arise because of the location of wounds.

### CLASSIFICATION OF WOUNDS

Wounds may be classified according to their general condition, size, location, the manner in which the skin or tissue is broken, and the agent that caused the wound. It is usually necessary for you to consider these factors to determine what first aid treatment is appropriate for the wound.

#### General Condition of the Wound

If the wound is fresh, first aid treatment consists mainly of stopping the flow of blood, treating for shock, and reducing the risk of infection. If the wound is already infected, first aid consists of keeping the victim quiet, elevating the injured part, and applying a warm wet dressing. If the wound contains foreign objects, first aid treatment may consist of removing the objects if they are not deeply embedded. DO NOT remove objects embedded in the eyes or the skull, and **do not** remove impaled objects. Stabilize impaled objects with a bulky dressing before transporting the victim.

#### Size of the Wound

In general, since large wounds are more serious than small ones, they usually involve more severe bleeding, more damage to the underlying organs or tissues, and a greater degree of shock. However, small wounds are sometimes more dangerous than large ones since they may become infected more readily due to neglect. The depth of the wound is also important because it may lead to a complete perforation of an organ or the body, with the additional complication of entrance and exit wounds.

#### Location of the Wound

Since a wound may involve serious damage to the deeper structures, as well as to the skin and the tissue immediately below it, the location of the wound is important. For example, a knife wound to the chest may puncture a lung and cause interference with breathing. The same type of wound in the abdomen may result in a dangerous infection in the abdominal cavity, or it might puncture the intestines, liver, kidneys, or other vital organs. A knife wound to the head may cause brain damage, but the same wound in a less vital spot (such as an arm or leg) might be less important.

#### Types of Wounds

When you consider the manner in which the skin or tissue is broken, there are six general kinds of wounds: abrasions, incisions, lacerations, punctures, avulsions, and amputations. Many wounds, of course, are combinations of two or more of these basic types.

**ABRASIONS**.—Abrasions are made when the skin is rubbed or scraped off. Rope burns, floor burns, and skinned knees or elbows are common examples of abrasions. This kind of wound can become infected quite easily because dirt and germs are usually embedded in the tissues.

**INCISIONS**.—Incisions, commonly called cuts, are wounds made by sharp cutting instruments such as knives, razors, and broken glass. Incisions tend to bleed freely because the blood vessels are cut cleanly and without ragged edges. There is little damage to the surrounding tissues. Of all classes of wounds, incisions are the least likely to become infected, since

the free flow of blood washes out many of the microorganisms (germs) that cause infection.

**LACERATIONS**.—These wounds are torn, rather than cut. They have ragged, irregular edges and masses of torn tissue underneath. These wounds are usually made by blunt (as opposed to sharp) objects. A wound made by a dull knife, for instance, is more likely to be a laceration than an incision. Bomb fragments often cause lacerations. Many of the wounds caused by accidents with machinery are lacerations; they are often complicated by crushing of the tissues as well. Lacerations are frequently contaminated with dirt, grease, or other material that is ground into the tissue. They are therefore very likely to become infected.

**PUNCTURES**.—Punctures are caused by objects that penetrate into the tissues while leaving a small surface opening. Wounds made by nails, needles, wire, and bullets are usually punctures. As a rule, small puncture wounds do not bleed freely; however, large puncture wounds may cause severe internal bleeding. The possibility of infection is great in all puncture wounds, especially if the penetrating object has tetanus bacteria on it. To prevent anaerobic infections, primary closures are not made in the case of puncture wounds.

**AVULSIONS**.—An avulsion is the tearing away of tissue from a body part. Bleeding is usually heavy. In certain situations, the torn tissue may be surgically reattached. It can be saved for medical evaluation by wrapping it in a sterile dressing and placing it in a cool container, and rushing it—along with the victim–to a medical facility. Do not allow the avulsed portion to freeze, and do not immerse it in water or saline.

**AMPUTATIONS**.—A traumatic amputation is the nonsurgical removal of the limb from the body. Bleeding is heavy and requires a tourniquet (which will be discussed later) to stop the flow. Shock is certain to develop in these cases. As with avulsed tissue, wrap the limb in a sterile dressing, place it in a cool container, and transport it to the hospital with the victim. Do not allow the limb to be in direct contact with ice, and do not immerse it in water or saline. The limb can often be successfully reattached.

### Causes of Wounds

Although it is not always necessary to know what agent or object has caused the wound, it is helpful. Knowing what has caused the wound may give you some idea of the probable size of the wound, its general nature, the extent to which it is likely to become contaminated with foreign matter, and what special dangers must be guarded against. Of special concern in a wartime setting is the velocity of wound-causing missiles (bullets or shrapnel). A low-velocity missile damages only the tissues it comes into contact with. On the other hand, a high-velocity missile can do enormous damage by forcing the tissues and body parts away from the track of the missile with a velocity only slightly less than that of the missile itself. These tissues, especially bone, may become damage-causing missiles themselves, thus accentuating the destructive effects of the missile.

Having classified the wound into one or more of the general categories listed, the Corpsman will have a good idea of the nature and extent of the injury, along with any special complications that may exist. This information will aid in the treatment of the victim.

## MANAGEMENT OF OPEN SOFT-TISSUE INJURIES

There are three basic rules to be followed in the treatment of practically all open soft tissue injuries: to control hemorrhage, to treat the victim for shock, and to do whatever you can to prevent infection. These will be discussed, along with the proper application of first aid materials and other specific first aid techniques.

### Hemorrhage

Hemorrhage is the escape of blood from the vessels of the circulatory system. The average adult body contains about 5 liters of blood. Five hundred milliliters of blood, the amount given by blood donors, can usually be lost without any harmful effect. The loss of 1 liter of blood usually causes shock, but shock may develop if small amounts of blood are lost rapidly, since the circulatory system does not have enough time to compensate adequately. The degree of shock progressively increases as greater amounts of blood escape. Young children, sick people, or the elderly may be especially susceptible to the loss of even small amounts of blood since their internal systems are in such delicate balance.

Capillary blood is usually brick red in color. If capillaries are cut, the blood oozes out slowly. Blood from the veins is dark red. Venous bleeding is characterized by a steady, even flow. If an artery near the surface is cut, the blood, which is bright red in color, will gush out in spurts that are synchronized with the heartbeats. If the severed artery is deeply buried,

however, the bleeding will appear to be a steady stream.

In actual practice, you might find it difficult to decide whether bleeding is venous or arterial, but the distinction is not usually important. The important thing to know is that all bleeding must be controlled as quickly as possible.

External hemorrhage is of greatest importance to the Corpsman because it is the most frequently encountered and the easiest to control. It is characterized by a break in the skin and visible bleeding. Internal hemorrhage (which will be discussed later) is far more difficult to recognize and to control.

**Control of Hemorrhage**

The best way to control external bleeding is by applying a compress to the wound and exerting pressure directly to the wound. If direct pressure does not stop the bleeding, pressure can also be applied at an appropriate pressure point. At times, elevation of an extremity is also helpful in controlling hemorrhage. The use of splints in conjunction with direct pressure can be beneficial. In those rare cases where bleeding cannot be controlled by any of these methods, you must use a tourniquet.

If bleeding does not stop after a short period, try placing another compress or dressing over the first and securing it firmly in place. If bleeding still will not stop, try applying direct pressure with your hand over the compress or dressing.

Remember that in cases of severe hemorrhage, it is less important to worry too much about finding appropriate materials or about the dangers of infection. The most important problem is to stop rapid exsanguination. If no material is available, simply thrust your hand into the wound. In most situations, direct pressure is the first and best method to use in the control of hemorrhage.

**Pressure Points**

Bleeding can often be temporarily controlled by applying hand pressure to the appropriate pressure point. A pressure point is the spot where the main artery to an injured part lies near the skin surface and over a bone. Apply pressure at this point with the fingers (digital pressure) or with the heel of the hand. No first aid materials are required. The object of the pressure is to compress the artery against the bone, thus shutting off the flow of blood from the heart to the wound.

There are 11 principal points on each side of the body where hand or finger pressure can be used to stop hemorrhage. These points are shown in figure 4-27. If bleeding occurs on the face below the level of the eyes, apply pressure to the point on the mandible. This is shown in figure 4-27A. To find this pressure point, start at the angle of the jaw and run your finger forward along the lower edge of the mandible until you feel a small notch. The pressure point is in this notch.

If bleeding is in the shoulder or in the upper part of the arm, apply pressure with the fingers behind the clavicle. You can press down against the first rib or forward against the clavicle; either kind of pressure will stop the bleeding. This pressure point is shown in figure 4-27B.

Bleeding between the middle of the upper arm and the elbow should be controlled by applying digital pressure to the inner (body) side of the arm, about halfway between the shoulder and the elbow. This compresses the artery against the bone of the arm. The application of pressure at this point is shown in figure 4-27C. Bleeding from the hand can be controlled by pressure at the wrist, as shown in figure 4-27D. If it is possible to hold the arm up in the air, the bleeding will be relatively easy to stop.

Figure 4-27E shows how to apply digital pressure in the middle of the groin to control bleeding from the thigh. The artery at this point lies over a bone and quite close to the surface, so pressure with your fingers may be sufficient to stop the bleeding.

Figure 4-27F shows the proper position for controlling bleeding from the foot. As in the case of bleeding from the hand, elevation is helpful in controlling the bleeding.

If bleeding is in the region of the temple or the scalp, use your finger to compress the main artery to the temple against the skull bone at the pressure point just in front of the ear. Figure 4-27G shows the proper position.

If the neck is bleeding, apply pressure below the wound, just in front of the prominent neck muscle. Press inward and slightly backward, compressing the main artery of that side of the neck against the bones of the spinal column. The application of pressure at this point is shown in figure 4-27H. Do not apply pressure at this point unless it is absolutely essential, since there

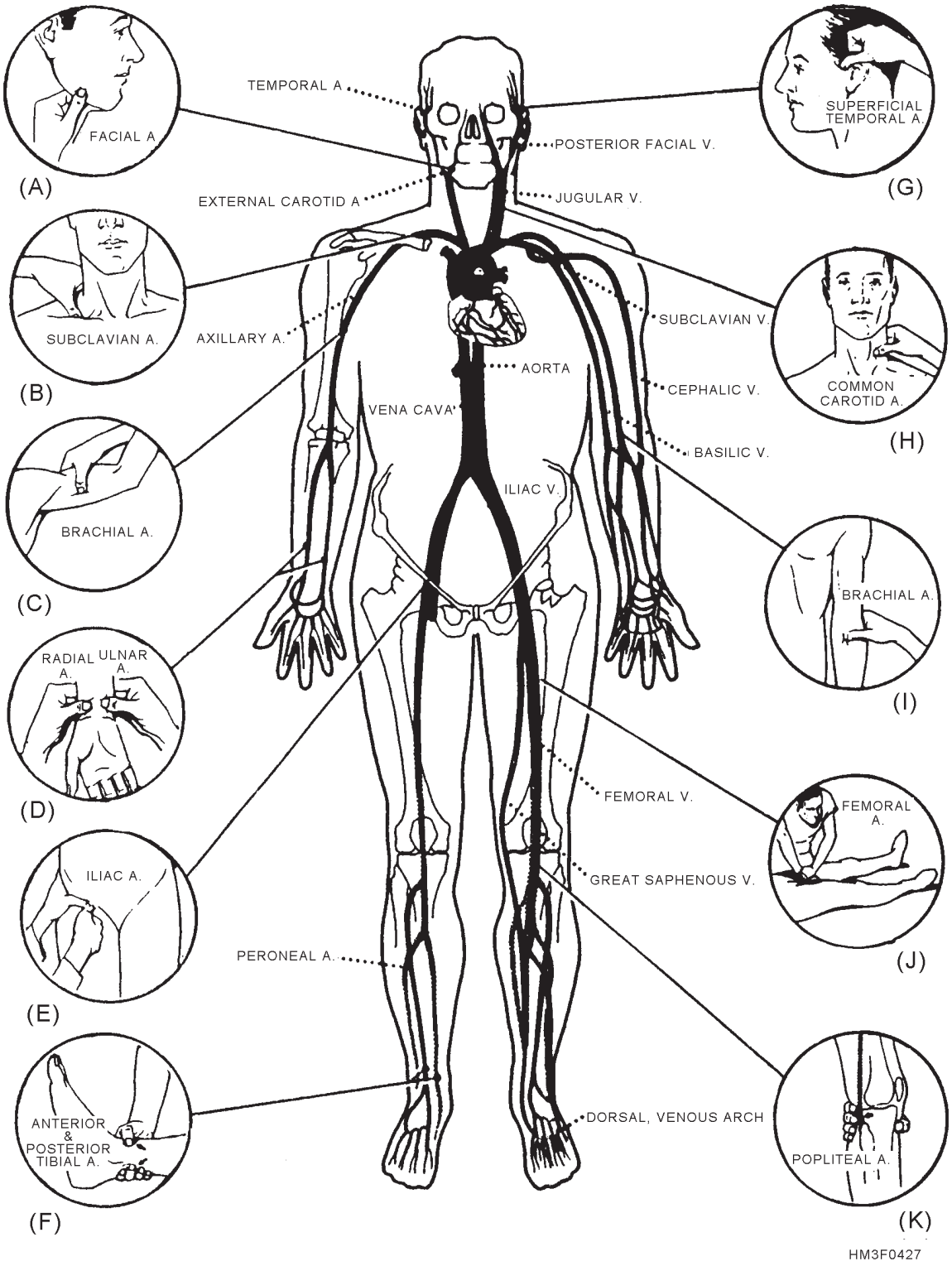


**Figure 4-27.—Pressure points.**

is a great danger of pressing on the windpipe, thereby choking the victim.

Bleeding from the lower arm can be controlled by applying pressure at the elbow, as shown in figure 4-27I.

As mentioned before, bleeding in the upper part of the thigh can sometimes be controlled by applying digital pressure in the middle of the groin, as shown in figure 4-27E. Sometimes, however, it is more effective to use the pressure point of the upper thigh, as shown in figure 4-27J. If you use this point, apply pressure with

the closed fist of one hand and use the other hand to give additional pressure. The artery at this point is deeply buried in some of the heaviest muscle tissue in the body, so a great deal of pressure must be exerted to compress the artery against the bone.

Bleeding between the knee and the foot may be controlled by firm pressure at the knee. If pressure at the side of the knee does not stop the bleeding, hold the front of the knee with one hand and thrust your fist hard against the artery behind the knee, as shown in figure 4-27K. If necessary, you can place a folded compress or bandage behind the knee, bend the leg back, and hold it in place by a firm bandage. This is a most effective way of controlling bleeding, but it is so uncomfortable for the victim that it should be used only as a last resort.

You should memorize these pressure points so that you will know immediately which point to use for controlling hemorrhage from a particular part of the body. Remember, the correct pressure point is that which is (1) **nearest the wound**, and (2) **between the wound and the main part of the body**.

It is very tiring to apply digital pressure, and it can seldom be maintained for more than 15 minutes. Pressure points are recommended for use while direct pressure is being applied to a serious wound by a second rescuer. Using the pressure-point technique is also advised after a compress, bandage, or dressing has been applied to the wound, since this method will slow the flow of blood to the area, thus giving the direct pressure technique a better chance to stop the hemorrhage. The pressure-point system is also recommended as a stopgap measure until a pressure dressing or a tourniquet can be applied.

**Elevation**

The elevation of an extremity, where appropriate, can be an effective aid in hemorrhage control when used in conjunction with other methods of control, especially direct pressure. This is because the amount of blood entering the extremity is decreased by the uphill gravitational effect. Do not elevate an extremity until it is certain that no bones have been broken or until broken bones are properly splinted.

**Splints**

Another effective method of hemorrhage control in cases of bone fractures is splinting. The immobilization of sharp bone ends reduces further tissue trauma and allows lacerated blood vessels to clot. In addition, the gentle pressure exerted by the splint helps the clotting process by giving additional support to compresses or dressings already in place over open fracture sites.

Later in this chapter we will go into the subject of splinting in greater detail.

**Tourniquets**

A tourniquet is a constricting band that is used to cut off the supply of blood to an injured limb. Use a tourniquet **only as a last resort** and if the control of hemorrhage by other means proves to be difficult or impossible. A tourniquet must always be applied **above** the wound (i.e., toward the trunk), and it must be applied as close to the wound as practical.

Basically, a tourniquet consists of a pad, a band, and a device for tightening the band so that the blood vessels will be compressed. It is best to use a pad, compress, or similar pressure object, if one is available. The pressure object goes under the band and must be placed directly over the artery or it will actually decrease the pressure on the artery, allowing a greater flow of blood. If a tourniquet placed over a pressure object does not stop the bleeding, there is a good chance that the pressure object is in the wrong place. If placement is not effective, shift the object around until the tourniquet, when tightened, will control the bleeding.

Any long flat material may be used as the band. It is important that the band be flat: belts, stockings, flat strips of rubber, or neckerchiefs may be used; however, rope, wire, string, or very narrow pieces of cloth should not be used because they can cut into the flesh. A short stick may be used to twist the band, tightening the tourniquet. Figure 4-28 shows the proper steps in applying a tourniquet.

To be effective, a tourniquet must be tight enough to stop the arterial blood flow to the limb. Be sure, therefore, to draw the tourniquet tight enough to stop the bleeding. Do not make it any tighter than necessary, though, since a tourniquet that is too tight can lead to loss of the limb the tourniquet is applied to.

After you have brought the bleeding under control with the tourniquet, apply a sterile compress or dressing to the wound and fasten it in position with a bandage.

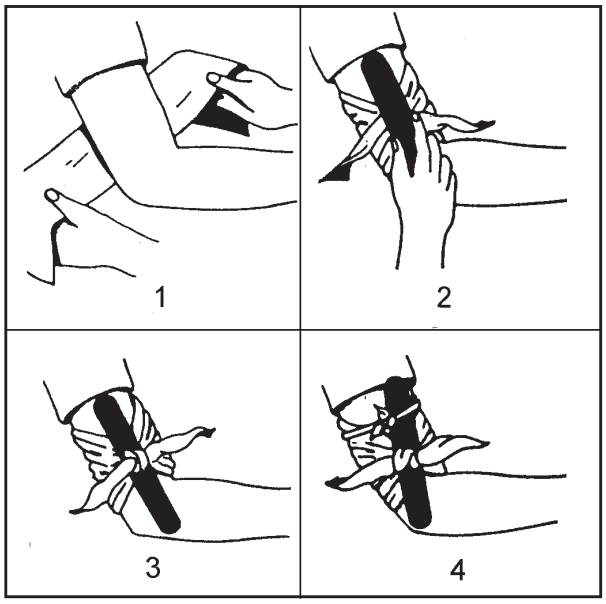


**Figure 4-28.—Applying a tourniquet.**

Here are the points to remember about using a tourniquet:

1. **Use a tourniquet only as a last resort!** Don't use a tourniquet unless you can't control the bleeding by any other means.
2. Don't use a tourniquet for bleeding from the head, face, neck, or trunk. Use it only on the limbs.
3. Always apply a tourniquet **above the wound** and as close to the wound as possible. As a general rule, do not place a tourniquet below the knee or elbow except for complete amputations. In certain distal areas of the extremities, nerves lie close to the skin and may be damaged by the compression. Furthermore, rarely does one encounter bleeding distal to the knee or elbow that requires a tourniquet.
4. Be sure you draw the tourniquet tight enough to stop the bleeding, but don't make it any tighter than necessary. The pulse beyond the tourniquet should disappear.
5. **Don't loosen a tourniquet after it has been applied.** Transport the victim to a medical facility that can offer proper care.
6. Don't cover a tourniquet with a dressing. If it is necessary to cover the injured person in some way, **make sure** that all the other people concerned with the case know about the tourniquet. Using crayon, skin pencil, or blood, mark a large "T" and the time the tourniquet was applied on the victim's forehead or on a medical tag attached to the wrist.

## MANAGEMENT OF INTERNAL SOFT-TISSUE INJURIES

Internal soft-tissue injuries may result from deep wounds, blunt trauma, blast exposure, crushing accidents, bone fracture, poison, or sickness. They may range in seriousness from a simple contusion to life-threatening hemorrhage and shock.

### Visible Indications

Visible indications of internal soft-tissue injury include the following:

- Hematemesis (vomiting bright red blood)
- Hemoptysis (coughing up bright red blood)
- Melena (excretion of tarry black stools)
- Hematochezia (excretion of bright red blood from the rectum)
- Hematuria (passing of blood in the urine)
- Nonmenstrual (vaginal bleeding)
- Epistaxis (nosebleed)
- Pooling of the blood near the skin surface

### Other Symptoms

More often than not, however, there will be no visible signs of injury, and the Corpsman will have to infer the probability of internal soft-tissue injury from other symptoms such as the following:

- Pale, moist, clammy skin
- Subnormal temperature
- Rapid, feeble pulse
- Falling blood pressure
- Dilated, slowly reacting pupils with impaired vision
- Tinnitus
- Syncope
- Dehydration and thirst
- Yawning and air hunger
- Anxiety, with a feeling of impending doom

### Immediate Treatment

There is little that a Corpsman can do to correct internal soft-tissue injuries since they are almost always surgical problems. The Hospital Corpsman's goal must be to obtain the greatest benefit from the victim's remaining blood supply. The following steps should be taken:

1. Treat for shock.
2. Keep the victim warm and at rest.
3. Replace lost fluids with a suitable blood volume expander. DO NOT give the victim anything to drink until the extent of the injury is known for certain.
4. Give oxygen, if available.
5. Splint injured extremities.
6. Apply cold compresses to identifiable injured areas.
7. Transport the victim to a medical treatment facility as soon as possible.

## SPECIAL CONSIDERATIONS IN WOUND TREATMENT

There are special considerations that should be observed when treating wounds. The first of these is immediate treatment to prevent shock. Next, infection should be a concern: Look for inflammation and signs of abscess. Hospital Corpsmen should be aware of these conditions and have the knowledge to treat them.

### Shock

Shock is likely to be severe in a person who has lost a large amount of blood or suffered any serious wound. The causes and treatment of shock are explained earlier in this chapter.

### Infection

Although infection may occur in any wound, it is a particular danger in wounds that do not bleed freely, in wounds in which torn tissue or skin falls back into place and prevents the entrance of air, and in wounds that involve the crushing of tissues. Incisions (in which there is a free flow of blood and relatively little crushing of tissues) are the least likely to become infected.

Battle wounds are especially likely to become infected. They present the problem of devitalized (dead or dying) tissue; extravasated blood (blood that has escaped its natural boundaries); foreign bodies such as missile fragments, bits of cloth, dirt, dust; and a variety of bacteria. The devitalized tissue proteins and extravasated blood provide a nutritional medium for the support of bacterial growth and thus are conducive to the development of serious wound infection. Puncture wounds are also likely to become infected by the germs causing tetanus.

**COMMON INFECTION-CAUSING BACTERIA.—** There are two types of bacteria that commonly cause infection in wounds: aerobic and anaerobic. Aerobic bacteria live and multiply in the presence of air or free oxygen, while anerobic bacteria live and multiply only in the absence of air.

**Aerobic Bacteria.—**The principal aerobic bacteria that cause infection, inflammation, and septicemia (blood poisoning) are streptococci and staphylococci, some varieties of which are hemolytic (destroy red blood cells). The staphylococci and streptococci may be introduced at the time of infliction, or they may be introduced to the wound later (at the time of first aid treatment or in the hospital if nonsterile instruments or dressings are employed).

**Anaerobic Bacteria.—**Anaerobic bacteria are widespread in soil (especially manured soil). While not invasive, anaerobic bacteria contribute to disease by producing toxins and destructive enzymes, often leading to necrosis and/or gangrene of the infected area.

**MINOR WOUND CLEANING AND DRESSING.—**Wash minor wounds immediately with soap and clean water; then dry and paint them with a mild, nonirritating antiseptic. Apply a dressing if necessary. In the first aid environment, do not attempt to wash or clean a large wound, and do not apply an antiseptic to it since it must be cleaned thoroughly at a medical treatment facility. Simply protect it with a large compress or dressing, and transport the victim to a medical treatment facility. After an initial soap and water cleanup, puncture wounds must also be directed to a medical treatment facility for evaluation.

### Inflammation

Inflammation is a local reaction to irritation. It occurs in tissues that are injured, but not destroyed. Symptoms include redness, pain, heat, swelling, and sometimes loss of motion.

The body's physiologic response to the irritation is to dilate local blood vessels, which increases the blood supply to the area. The increased blood flow, in turn, causes the skin to appear red and warmer. As the blood vessels dilate, their injured walls leak blood serum into surrounding tissues, causing edema and pain from increased pressure on nerve endings. In addition, white blood cells increase in the area and act as scavengers (phagocytes) in destroying bacteria and ingesting small particles of dead tissue and foreign matter.

Inflammation may be caused by trauma or mechanical irritation; chemical reaction to venom, poison ivy, acids, or alkalies; heat or cold injuries; microorganism penetration; or other agents such as electricity or solar radiation.

Inflammation should be treated by the following methods:

- Remove the irritating cause.
- Keep the inflamed area at rest and elevated.
- Apply cold for 24 to 48 hours to reduce swelling. Once swelling is reduced, apply heat to soft tissues, which hastens the removal of products of inflammation.
- Apply wet dressings and ointments to soften tissues and to rid the area of the specific causal bacteria.

### Abscesses

An abscess is a localized collection of pus that forms in cavities created by the disintegration of tissue. Abscesses may follow injury, illness, or irritation. Most abscesses are caused by staphylococcal infections and may occur in any area of the body, but they are usually on the skin surface.

A **furuncle** (boil) is an abscess in the true skin caused by the entry of microorganisms through a hair follicle or sweat gland. A **carbuncle** is a group of furuncular abscesses having multiple sloughs, often interconnected under the true skin. When localized, there are several "heads." Symptoms begin with localized itching and inflammation, followed by swelling, fever, and pain. Redness and swelling localize, and the furuncle or carbuncle becomes hard and painful. Pus forms into a cavity, causing the skin to become taut and discolored.

Treatment for furuncles and carbuncles includes the following:

- **DO NOT** squeeze! Squeezing may damage surrounding healthy tissue and spread the infection.
- Use aseptic techniques when handling.
- Relieve pain with aspirin.
- Apply moist hot soaks/dressings (110°F) for 40 minutes, three to four times per day.
- Rest and elevate the infected body part.
- Antibiotic therapy may be ordered by a physician.
- Abscesses should be incised after they have localized (except on the face) to establish drainage. Abscesses in the facial triangle (nose and upper lip) should be seen by a physician.

## SPECIAL WOUNDS AND THEIR TREATMENT

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**LEARNING OBJECTIVE:** *Recall medical precautions and wound-treatment procedures for the following list of wounds: animal bites, eye wounds, head wounds, facial wounds, abdominal wounds, crushing injuries, and the removal of foreign objects.*

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As a Hospital Corpsman, you should find most general wounds very easy to diagnose and treat. There are other wounds, however, that require special consideration and treatment. They are discussed below.

### Eye Wounds

Many eye wounds contain foreign objects. Dirt, coal, cinders, eyelashes, bits of metal, and a variety of other objects may become lodged in the eye. Since even a small piece of dirt is intensely irritating to the eye, the removal of such objects is important. However, the eye is easily damaged. Impairment of vision (or even total loss of vision) can result from fumbling, inexpert attempts to remove foreign objects from the eye. The following precautions **must** be observed:

- **DO NOT** allow the victim to rub the eye.

- **DO NOT** press against the eye or manipulate it in any way that might cause the object to become embedded in the tissues of the eye. Be very gentle; roughness is almost sure to cause injury to the eye.

- **DO NOT** use such things as knives, toothpicks, matchsticks, or wires to remove the object.

- **DO NOT UNDER ANY CIRCUMSTANCES ATTEMPT TO REMOVE AN OBJECT THAT IS EMBEDDED IN THE EYEBALL OR THAT HAS PENETRATED THE EYE!** If you see a splinter or other object sticking out from the eyeball, leave it alone! Only specially trained medical personnel can hope to save the victim's sight if an object has actually penetrated the eyeball.

Small objects that are lodged on the surface of the eye or on the membrane lining the eyelids can usually be removed by the following procedures:

1. Try to wash the eye gently with lukewarm, sterile water. A sterile medicine dropper or a sterile syringe can be used for this purpose. Have the victim lie down, with the head turned slightly to one side as shown in figure 4-29. Hold the eyelids apart. Direct the flow of water to the **inside** corner of the eye, and let it run down to the **outside** corner. Do not let the water fall directly onto the eyeball.

2. Gently pull the lower lid down, and instruct the victim to look up. If you can see the object, try to remove it with the corner of a clean handkerchief or with a small moist cotton swab. You can make the swab by twisting cotton around a wooden applicator, not too tightly, and moistening it with sterile water.

   **CAUTION**: Never use **dry** cotton anywhere near the eye. It will stick to the eyeball or to the inside of the lids, and you will have the problem of removing it as well as the original object.

3. If you cannot see the object when the lower lid is pulled down, turn the upper lid back over a smooth wooden applicator. Tell the victim to look down. Place the applicator lengthwise across the center of the upper lid. Grasp the lashes of the upper lid gently but firmly. Press gently with the applicator. Pull up on the eyelashes, turning the lid back over the applicator. If you can see the object, try to remove it with a moist cotton swab or with the corner of a clean handkerchief.


**Figure 4-29.—Irrigating the eye.**

4. If the foreign object cannot be removed by any of the above methods, **DO NOT MAKE ANY FURTHER ATTEMPTS TO REMOVE IT.** Instead, place a small, thick gauze dressing over both eyes and hold it in place with a **loose** bandage. This limits movement of the injured eye.

5. Get medical help for the victim at the earliest opportunity.

### Head Wounds

Head wounds must be treated with particular care, since there is always the possibility of brain damage. The general treatment for head wounds is the same as that for other fresh wounds. However, certain special precautions must be observed if you are giving first aid to a person who has suffered a head wound.

- **NEVER GIVE ANY MEDICATIONS**.

- Keep the victim lying flat, with the head at the level of the body. Do not raise the feet if the face is flushed. If the victim is having trouble breathing, you may raise the head slightly.

- If the wound is at the back of the head, turn the victim on his side.

- Watch closely for vomiting and position the head to avoid aspiration of vomitus or saliva into the lungs.

- Do not use direct pressure to control hemorrhage if the skull is depressed or obviously fractured.

**Facial Wounds**

Wounds of the face are treated, in general, like other fresh wounds. However, in all facial injuries make sure neither the tongue nor injured soft tissue blocks the airway, causing breathing obstruction. Keep the nose and throat clear of any obstructing materials, and position the victim so that blood will drain out of the mouth and nose.

Facial wounds that involve the eyelids or the soft tissue around the eye must be handled carefully to avoid further damage. If the injury does not involve the eyeball, apply a sterile compress and hold it in place with a **firm** bandage. If the eyeball appears to be injured, use a **loose** bandage. (Remember that you must **NEVER** attempt to remove any object that is embedded in the eyeball or that has penetrated it; just apply a dry, sterile compress to cover both eyes, and hold the compress in place with a **loose bandage**).

Any person who has suffered a facial wound that involves the eye, the eyelids, or the tissues around the eye must receive medical attention as soon as possible. Be sure to keep the victim lying down. Use a stretcher for transport.

**Chest Wounds**

Since chest injuries may cause severe breathing and bleeding problems, all chest injuries must be considered as serious conditions. Any victim showing signs of difficulty in breathing without signs of airway obstruction must be inspected for chest injuries. The most serious chest injury that requires immediate first aid treatment is the **sucking chest wound**. This is a penetrating injury to the chest that produces a hole in the chest cavity. The chest hole causes the lung to collapse, preventing normal breathing functions. This is an extremely serious condition that will result in death if not treated quickly.

Victims with open chest wounds gasp for breath, have difficulty breathing out, and may have a bluish skin color to their face. Frothy-looking blood may bubble from the wound during breathing.

The proper treatment for a sucking chest wound is as follows:

1. Immediately seal the wound with a hand or any airtight material available (e.g., ID card). The material must be large enough so that it cannot be sucked into the wound when the victim breathes in.
2. Firmly tape the material in place with strips of adhesive tape and secure it with a pressure dressing. It is important that the dressing is airtight. If it is not, it will not relieve the victim's breathing problems. The object of the dressing is to keep air from going in through the wound.

   **NOTE**: If the victim's condition suddenly deteriorates when you apply the seal, remove it **immediately**.

3. Give the victim oxygen if it is available and you know how to use it.
4. Place the victim in a Fowler's or semi-Fowler's position. This makes breathing a little easier. During combat, lay the victim on a stretcher on the affected side.
5. Watch the victim closely for signs of shock, and treat accordingly.
6. Do not give victims with chest injuries anything to drink.
7. Transport the victim to a medical treatment facility immediately.

**Abdominal Wounds**

A deep wound in the abdomen is likely to constitute a major emergency since there are many vital organs in this area. Abdominal wounds usually cause intense pain, nausea and vomiting, spasm of the abdominal muscles, and severe shock. Immediate surgical treatment is almost always required; therefore, the victim must receive medical attention at once, or the chances of survival will be poor. Give only the most essential first aid treatment, and concentrate your efforts on getting the victim to a medical treatment facility. The following first aid procedures may be of help to a person suffering from an abdominal wound:

- Keep the victim in a supine position. If the intestine is protruding or exposed, the victim may be more comfortable with the knees drawn up. Place a coat, pillow, or some other bulky cloth material under the knees to help maintain this position. **DO NOT ATTEMPT TO PUSH THE INTESTINES BACK IN OR TO MANIPULATE THEM IN ANY WAY!**

- If bleeding is severe, try to stop it by applying direct pressure.

- If the intestines are not exposed, cover the wound with a dry sterile dressing. If the intestines are exposed, apply a sterile compress moistened with sterile water. If no sterile water is available, clean sea water or any water that is fit to drink may be used to moisten the compress. Figure 4-30 shows an abdominal wound with the intestine protruding. Figure 4-31 shows the application of compresses large enough to cover the wound and the surrounding area. The compress should be held in place by a bandage. Fasten the bandage firmly so that the compress will not slip around, but do not apply any more pressure than is necessary to hold the compress in position. Large battle dressings are ideal.

- Treat for shock, but do not waste any time doing it. The victim must be transported to a hospital at the earliest possible opportunity. However, you can minimize the severity of shock by making sure that the victim is comfortably warm and kept in the supine position. **DO NOT GIVE ANYTHING TO DRINK**. If the victim is

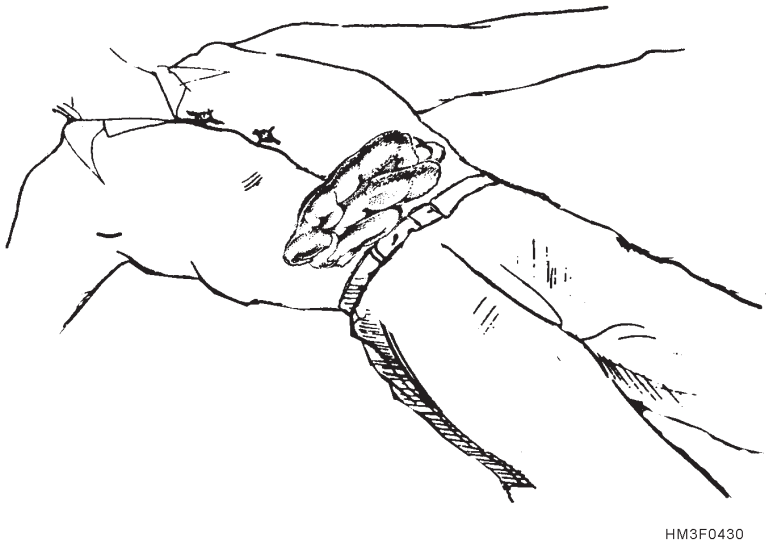


**Figure 4-30.—Protruding abdominal wounds.**


**Figure 4-31.—Applying compresses to a protruding abdominal wound.**

thirsty, moisten the mouth with a small amount of water, but do not allow any liquid to be swallowed.

- Upon the direction of a medical officer, start an intravenous line.

**Crush Injuries**

Force can be transmitted from the body's exterior to its interior structure, leaving the skin intact, with a simple bruise as the only external evidence of trauma. This force can cause internal organs to be crushed or to rupture and bleed. When this happens, it is called a **crush injury**. Organs such as the liver and spleen contain a lot of blood. When crushed, these organs bleed severely, and this severe internal bleeding can cause shock. Contents of hollow organs (e.g., urine or digested food) can leak into the body cavities, causing severe inflammation and tissue damage. Bones can also be broken along with muscles, and nerves damaged. Assessment and treatment for the Hospital Corpsman can be difficult when a crush injury is involved. Treat symptomatically and evacuate to the nearest medical treatment facility as soon as possible.

**Removing Foreign Objects**

Many wounds contain foreign objects. Wood or glass splinters, bullets, metal fragments, bits of wire, fishhooks, nails, tacks, cinders, and small particles from grinding wheels are examples of the variety of objects or materials that are sometimes found in wounds. When such objects are near the surface and exposed, first aid treatment includes their removal. However, first aid treatment does not include the removal of deeply embedded objects, powdered glass, or any widely scattered material of this nature. You should never attempt to remove bullets, but you should try to find out whether the bullet remains in the victim. Look for both entrance and exit wounds. The general rule to remember is this: Remove foreign objects from a wound when you can do so easily and without causing further damage; but **NEVER HUNT FOR OR ATTEMPT TO REMOVE DEEPLY BURIED OR WIDELY SCATTERED OBJECTS OR MATERIALS,** except in a definitive care environment.

The following procedure may be used to remove a small object from the skin or tissues if the object is near the surface and clearly visible:

1. Cleanse the skin around the object with soap and water and paint with any available skin antiseptic solution.
2. If necessary, pierce the skin with a sharp instrument (a needle, razor, or sharp knife that has been sterilized by passing it through a flame several times).
3. Grasping the object at the end, remove it. Tweezers, small pincers, or forceps may be used for this purpose. (Whatever instrument you use should first be sterilized by boiling if at all possible.)
4. If the wound is superficial, apply gentle pressure to encourage bleeding.
5. Cover the wound with a dry, sterile dressing.

If the foreign object is under a fingernail or toenail, you may have to cut a V-shaped notch in the nail so that the object can be grasped by the forceps. Do not try to dig the object out from under the nail with a knife or similar instrument.

A curved or barbed object (such as a fishhook) may present special problems. Figure 4-32 shows one method of removing a fishhook that has become embedded in the flesh. As you can see from figure 4-32A, the barb on the hook prevents its direct removal. However, if you push the hook forward through the skin, as shown in figure 4-32B, you can clip off the barb with a wire cutter or similar tool, as shown in figure 4-32. The remainder of the fishhook

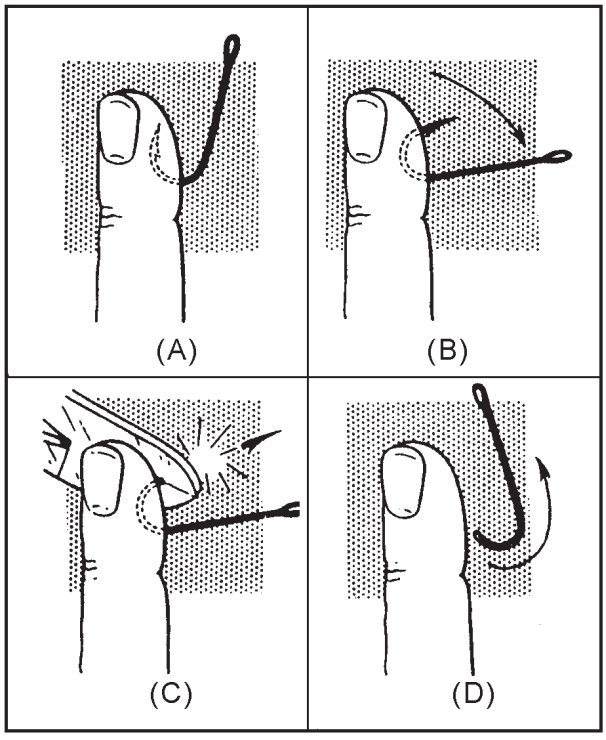


**Figure 4-32.—Removing a fishhook.**

can then be withdrawn in the manner indicated in figure 4-32D.

**Animal Bites**

A special kind of infection that must be guarded against in case of animal bites is rabies (sometimes called "hydrophobia"). This disease is caused by a virus that is present in the saliva of infected animals. The disease occurs most commonly in wild animals, but it has been found in domestic animals and household pets. In fact, it is probable that all mammals are susceptible to it. The virus that causes rabies is ordinarily transmitted by a bite, but it can be transmitted by the saliva of an infected animal coming in contact with a fresh wound or with the thin mucous membrane of the lips or nose. The virus does not penetrate normal unbroken skin. If the skin is broken, **DO NOT** attempt wound closure.

If rabies develops in man, it is usually fatal. A preventive treatment is available and it is very effective, but only if it is started shortly after the bite. This treatment is outlined in BUMEDINST 6220.6. Since the vaccine can be obtained only at a medical treatment facility or a major ship, any person bitten by an animal **must** be transferred quickly to the nearest treatment facility for evaluation, along with a complete report of the circumstances surrounding the incident. Remember, prevention is of utmost importance.

Immediate local treatment of the wound should be given. Wash the wound and the surrounding area carefully, using sterile gauze, soap, and sterile water. Use sterile gauze to dry the wound, and then cover the wound with a sterile dressing. **DO NOT** use any chemical disinfectant. Do not attempt to cauterize the wound in any way.

All of the animal's saliva must be removed from the victim's skin to prevent further contamination of the wound.

> **CAUTION: DO NOT** allow the animal's saliva to come in contact with open sores or cuts on your hands.

When a person has been bitten by an animal, every effort must be made to catch the animal and to keep it confined for a minimum of 8 to 10 days. **DO NOT** kill it if there is any possible chance of catching it alive. The symptoms of rabies are not always present in the animal at the time the bite occurs, but the saliva may nevertheless contain the rabies virus. It is essential, therefore, that the animal is kept under observation until a diagnosis can be made. The rabies treatment is given if the animal develops any definite symptoms, if it dies during the observation period, or if for any reason the animal cannot be kept under observation.

Remember that any animal bite is dangerous and **MUST** be evaluated at a treatment facility.

**WOUND CLOSURE**

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**LEARNING OBJECTIVE:** *Recognize the different types of suture material and their uses; recall topical, local infiltration and nerve-block anesthetic administration procedures; and identify the steps in wound suturing and suture removal.*

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The care of the wound is largely controlled by the tactical situation, facilities available, and the length of time before proper medical care may be available. Normally, the advice to the Corpsman regarding the suturing of wounds is **DO NOT ATTEMPT IT**. However, if days are expected to elapse before the patient can be seen by a surgeon, the Corpsman should know how to use the various suture procedures and materials, and how to select the most appropriate of both.

Before discussing the methods of coaptation (bringing together), some of the contraindications to wound closing should be described.

- If there is reddening and edema of the wound margins, infection manifested by the discharge of pus, and persistent fever or toxemia, **DO NOT CLOSE THE WOUND**. If these signs are minimal, the wound should be allowed to "clean up." The process may be hastened by warm, moist dressings, and irrigations with sterile saline. These aid in the liquefaction of necrotic wound materials and the removal of thick exudates and dead tissues.

- If the wound is a puncture wound, a large gaping wound of the soft tissue, or an animal bite, leave it unsutured. Even under the care of a surgeon, it is the rule **not** to close wounds of this nature until after the fourth day. This is called "delayed primary closure" and is performed upon the indication of a healthy appearance of the wound. Healthy muscle tissue that is viable is evident by its color, consistency, blood supply, and contractibility. Muscle that is dead or dying is comparatively dark and mushy; it does not

contract when pinched, nor does it bleed when cut. If this type of tissue is evident, do not close the wound.

- If the wound is deep, consider the support of the surrounding tissue; if there is not enough support to bring the deep fascia together, do not suture because dead (hollow) spaces will be created. In this generally gaping type of wound, muscles, tendons, and nerves are usually involved. Only a surgeon should attempt to close this type of wound.

**NOTE:** To a certain extent, firm pressure dressings and immobilization can obliterate hollow spaces. If tendons and nerves do not seem to be involved, absorbable sutures may be placed in the muscle. Be careful to suture muscle fibers end-to-end and to correctly appose them. Close the wound in layers. This is extremely delicate surgery, and the Corpsman should weigh carefully the advisability of attempting it–and then only if he has observed and assisted in numerous surgical operations.

If the wound is small, clean, and free from foreign bodies and signs of infection, steps should be taken to close it. All instruments should be checked, cleaned, and thoroughly sterilized. Use a good light and position the patient on the table so that access to the wound will be unhampered.

The area around the wound should be cleansed and then prepared with an antiseptic. The wound area should be draped, whenever possible, to maintain a sterile field in which the Corpsman will work. The Corpsman should wear a cap and mask, scrub his hands and forearms, and wear sterile gloves.

### Suture Materials

In modern surgery, many kinds of ligature and suture materials are used. All can be grouped into two classes: nonabsorbable sutures and absorbable sutures.

**NONABSORBABLE SUTURES.—**These are sutures that cannot be absorbed by the body cells and fluids in which they are embedded during the healing process. When used as buried sutures, these sutures become surrounded or encapsulated in fibrous tissue and remain as innocuous foreign bodies. When used as skin sutures, they are removed after the skin has healed. The most commonly used sutures of this type and the characteristics associated with each are listed below.

- **Silk**—frequently reacts with tissue and can be "spit" from the wound.
- **Cotton**—loses tensile strength with each autoclaving.
- **Linen**—is better than silk or cotton but is more expensive and not as readily available.
- **Synthetic materials** (e.g., nylon, dermalon)—are excellent, particularly for surface use. They cause very little tissue reaction. Their only problem seems to be the tendency for the knots to come untied. (Because of this tendency, most surgeons tie 3 to 4 square knots in each such suture.) Nylon is preferred over silk for face and lip areas because silk too often causes tissue reactions.
- **Rust-proof metal** (usually stainless steel wire)—has the least tissue reaction of all suture materials and is by far the strongest. The primary problems associated with it are that it is more difficult to use because it kinks and that it must be cut with wire cutters.

**ABSORBABLE SUTURES**.—These are sutures that are absorbed or digested during and after the healing processes by the body cells and tissue fluids in which they are embedded. It is this characteristic that enhances their use beneath the skin surfaces and on mucous membranes.

Surgical gut fulfills the requirements for the perfect suture—ease of manufacture, tensile strength, and variety available—more often than any other material.

- **Manufacture of catgut**: Though it is referred to as "catgut," surgical gut is derived from the submucosal connective tissue of the first one-third (about 8 yards) of the small intestine of healthy government-inspected sheep. The intestine of the sheep has certain characteristics that make it especially adaptable for surgical use. Among these characteristics is its uniformly fine-grained tissue structure and its great tensile strength and elasticity.
- **Tensile strength of catgut**: This suture material is available in sizes of 6-0 to 0 and 1 to 4, with 6-0 being the smallest diameter and 4 being the largest. The tensile strength increases with the diameter of the suture.

- **Varieties of catgut**: Surgical gut varies from plain catgut (the raw gut that has been gauzed, polished, sterilized, and packaged) to chromic catgut (that has undergone various intensities of tanning with one of the salts of chromic acid to delay tissue absorption time). Some examples of these variations and their absorption times follow in table 4–3.

**Suture Needles**

Suture needles may be straight or curved, and they may have either a tapered round point or a cutting edge point. They vary in length, curvature, and diameter for various types of suturing. Specific characteristics of suture needles are listed below.

- **Size**: Suture needles are sized by diameter and are available in many sizes.
- **Taper point**: Most often used in deep tissues, this type **needle causes minimal amounts of tissue damage.**
- **Cutting edge point:** This type needle is preferred for suturing the skin because of the needle's ability to penetrate the skin's toughness.
- **Atraumatic (atraloc, wedged)**: These needles may either have a cutting edge or a taper point. Additionally, the suture may be fixed on the end of the needle by the manufacturer to cause the least tissue trauma.

**Preparation of Casualty**

Before suturing the wound(s) of any victim, the following steps should be taken to prepare the casualty.

1. Examine the casualty carefully to determine what materials are needed to properly close the wound.
    a. Select and prepare sterile instruments, needles, and suture materials.
    b. Position the patient securely so that access to the wound and suture tray is optimal. It is usually not necessary to restrain patients for suturing.
    c. Make sure a good light is available.
2. Strictly observe aseptic wound preparation. Use mask, cap, and gloves. Thorough cleaning and proper draping are essential.
3. Select an anesthetic with care. Consider the patient's tolerance to pain, time of injury, medications the patient is taking or has been given, and the possible distortion of the tissue when the anesthetic are infiltrated.

**Table 4-3.—Absorption Times of Various Types of Surgical Gut**

| Type Gut | Absorption Time |
|---|---|
| A: Plain | 10 days |
| B: Mild chromic | 20 days |
| C: Medium chromic | 30 days |
| D: Extra chromic | 40 days |

**SELECTION OF ANESTHESIA.—**The most common local anesthetic used is Xylocaine®, which comes in various strengths (0.5%, 1%, 2%) and with or without epinephrine. Injectables containing epinephrine must never be used on the fingers, toes, ears, nose–any appendage with small vessels–because of the vasoconstricting effect of the epinephrine. Epinephrine is also contraindicated in patients with hypertension, diabetes, or heart disease.

The three methods of anesthestia administration are topical, local infiltration, and nerve block. Topical anesthetics are generally reserved for ophthalmic or plastic surgery, and nerve blocks are generally accomplished by an anesthesiologist or anesthetist for the surgical patient. For a Corpsman, topical anesthesia is limited to the instillation of eye drops for mild corneal abrasions after all foreign bodies have been removed. **DO NOT** attempt to remove embedded foreign bodies. Nerve blocks are limited to digital blocks wherein the nerve trunks that enervate the fingers or toes are anesthetized. The most common method of anesthesia used by a Corpsman is the infiltration of the anesthetizing agent around a wound or minor surgical site.

**ADMINISTRATION OF ANESTHESIA.—** Performing a digital block is a fairly simple procedure, but it should not be attempted except under the supervision of a medical officer or after a great deal of practice. The first step is cleansing the injection site with an antiseptic solution. The anesthetizing agent is then infiltrated into the lateral and medial aspects at the base of the digit with a small bore needle (25- or 26-gauge), taking care not to inject into the veins or arteries. Proper placement of the anesthesia should result in a loss of sensitivity in a few minutes. This is tested by asking the patient if he can distinguish a sharp

sensation or pain when a sharp object is gently applied to the skin.

Administering local anesthesia is similar except you are anesthetizing nerves immediately adjacent to where you will be working instead of nerve trunks. There are two generally accepted methods of infiltrating the anesthesia. One is through the skin surrounding the margin of the wound and the other is through the wound into the surrounding tissue. In either case, sufficient quantities must be infiltrated to effect anesthesia approximately ½ inch around the wound, taking care not to inject into a vein or artery.

> **CAUTION**: The maximum recommended amount of Xylocaine to be used is 50 cc for a 1% solution or the equivalent.

**General Principles of Wound Suturing**

Wounds are closed either primarily or secondarily. A **primary closure** takes place within a short time of when the wound occurs, and it requires minimal cleaning and preparation. A **secondary closure**, on the other hand, occurs when there is a delay of the closure for up to several days after the wound's occurrence. A secondary closure requires a more complex procedure. Wounds 6 to 14 hours old may be closed primarily if they are not grossly contaminated and are meticulously cleaned. Wounds 14 to 24 hours old should not be closed primarily. When reddening and edema of the wound margins, discharge of pus, persistent fever, or toxemia are present, do not close the wound.

Do not use a primary closure for a large, gaping, soft-tissue wound. This type of wound will require warm dressings and irrigations, along with aseptic care for 3 to 7 days to clear up the wound. Then a secondary wound closure may be performed.

The steps to perform a delayed wound closure are outlined below.

1. Debride the wound area and convert circular wounds to elliptical ones before suturing. Circular wounds cannot be closed with satisfactory cosmetic results.
2. Try to convert a jagged laceration to one with smooth edges before suturing it. Make sure that not too much skin is trimmed off; that would make the wound difficult to approximate.
3. Use the correct technique for placing sutures. The needle holder is applied at approximately one-quarter of the distance from the blunt end of the needle. Suturing with a curved needle is done toward the person doing the suturing. Insert the needle into the skin at a 90° angle, and sweep it through in an arclike motion, following the general arc of the needle.
4. Carefully avoid bruising the skin edges being sutured. Use Adson forceps and very lightly grasp the skin edges. It is improper to use dressing forceps while suturing. Since there are no teeth on the grasping edges of the dressing forceps, the force required to hold the skin firmly may be enough to cause necrosis.
5. Do not put sutures in too tightly. Gentle approximation of the skin is all that is necessary. Remember that postoperative edema will occur in and about the wound, making sutures tighter. Figure 4-33 illustrates proper wound-closure techniques.
6. If there is a significant chance that the sutured wound may become infected (e.g., bites, delayed closure, gross contamination), place an iodoform (anti-infective) in the wound. Or place a small rubber drain in the wound, and remove the drain in 48 hours.
7. When suturing, the best cosmetic effect is obtained by using numerous interrupted simple sutures placed 1/8 inch apart. Where cosmetic result is not a consideration, sutures may be slightly farther apart. Generally, the distance of the needle bite from the wound edges should be equal to the distance between sutures.
8. When subcutaneous sutures are needed, it is proper to use 4-0 chromic catgut.
9. When deciding the type of material to use on skin, use the finest diameter that will satisfactorily hold the tissues. Table 4-4 provides guidance as to the best suture to use in selected circumstances.
10. When cutting sutures, subcutaneous catgut should have a 1/16-inch tail. Silk skin sutures should be cut as short as is practical for removal on the face and lip. Elsewhere, skin sutures may have longer tails for convenience. A tail over ¼ inch is unnecessary, however, and tends to collect exudate.
11. The following general rules can be used in deciding when to remove sutures:
    a. **Face**: As a general rule, 4 or 5 days. Better cosmetic results are obtained by removing every other suture and any suture with

redness around it on the third day and the remainder on the fifth day.

b. **Body and scalp**: 7 days.

c. **Soles, palms, back, or over joints**: 10 days, unless excess tissue reaction is apparent around the suture, in which case they should come out sooner.

d. Any suture with pus or infection around it should be removed immediately, since the suture's presence will make the infection worse.

e. When wire is used, it may be left in safely for 10 to 14 days.

## ORTHOPEDIC INJURIES

Many kinds of accidents cause injuries to bones, joints, or muscles. In giving first aid or emergency treatment to an injured person, you must always look for signs of fractures (broken bones), dislocations, sprains, strains, and contusions.

An essential part of the emergency treatment for fractures consists of immobilizing the injured part with splints so that the sharp ends of broken bones will not move around and cause further damage to nerves, blood vessels, or vital organs. Splints are also used to immobilize severely injured joints or muscles and to prevent the enlargement of extensive wounds. You must have a general understanding of the use of splints before going on to learn the detailed first aid treatment for injuries to bones, joints, and muscles.

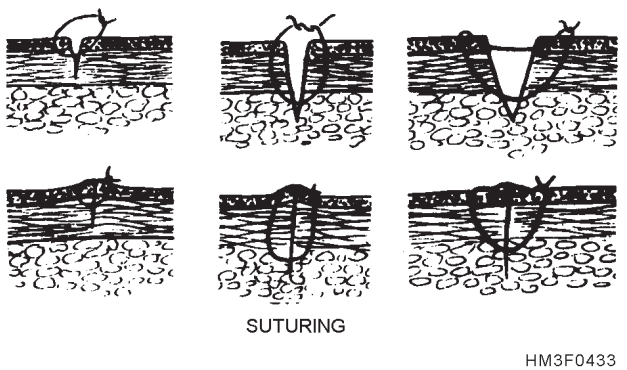


**Figure 4-33.—Suturing.**

**Table 4-4.—Suture Guide**

| Wound | Suture Material/Size |
|---|---|
| Children under 3 years | 6-0 |
| All other faces | 5-0 |
| Body | 4-0 |
| Feet, elbows, knees | #34 or #36 wire, or 4-0 |
| Child's scalp | 4-0 |
| Adult's scalp | 3-0 |
| Lip | 6-0 or 5-0 |

## SPLINTS

**LEARNING OBJECTIVE:** *Recognize the different types of splints that are available, and determine how and when they should be used.*

In an emergency, almost any firm object or material will serve as a splint. Thus, umbrellas, canes, rifles, tent pegs, sticks, oars, wire mesh, boards, corrugated cardboard, and folded newspapers can be used as splints. A fractured leg may sometimes be splinted by fastening it securely to the uninjured leg. Whenever available, use manufactured splints such as pneumatic splints or traction splints.

### Requirements

Splints, whether manufactured or improvised, must fulfill certain requirements. They should be lightweight, strong, fairly rigid, and long enough to reach past the joints above and below the fracture. They should be wide enough so that the bandages used to hold them in place will not pinch the injured part. Splints must be well padded on the sides touching the body; if they are not properly padded, they will not fit well and will not adequately immobilize the injured part. If you have to improvise the padding for a splint, you may use clothing, bandages, cotton, blankets, or any other soft material. If the victim is wearing heavy clothes, you may be able to apply the splint on the outside, allowing the clothing to serve as at least part of the required padding. Fasten splints in place with

bandages, strips of adhesive tape, clothing, or other suitable materials. If possible, one person should hold the splints in position while another person fastens them.

### Application

Although splints should be applied snugly, they should **never** be tight enough to interfere with the circulation of the blood. When you are applying splints to an arm or a leg, try to leave the fingers or toes exposed. If the tips of the fingers or toes become blue or cold, you will know that the splints or bandages are too tight. You should examine a splinted part approximately every half hour and loosen the fastenings if the circulation appears to be impaired. Remember that any injured part is likely to swell, and splints or bandages that are otherwise applied correctly may later become too tight.

## MANAGEMENT OF BONE INJURIES

**LEARNING OBJECTIVE:** *Select the appropriate stabilization and treatment procedure for the management of bone injuries.*

A break in a bone is called a **fracture**. There are two main kinds of fractures. A **closed fracture** is one in which the injury is entirely internal; the bone is broken but there is no break in the skin. An **open fracture** is one in which there is an open wound in the tissues and the skin. Sometimes the open wound is made when a sharp end of the broken bone pushes out through the flesh; sometimes it is made by an object such as a bullet that penetrates from the outside.

Figure 4-34 shows closed and open fractures.

Open fractures are more serious than closed fractures. They usually involve extensive damage to the tissues and are quite likely to become infected. Closed fractures are sometimes turned into open fractures by rough or careless handling of the victim.

It is not always easy to recognize a fracture. All fractures, whether closed or open, are likely to cause severe pain and shock; but the other symptoms may vary considerably. A broken bone sometimes causes the injured part to be deformed or to assume an unnatural position. Pain, discoloration, and swelling may be localized at the fracture site, and there may be a

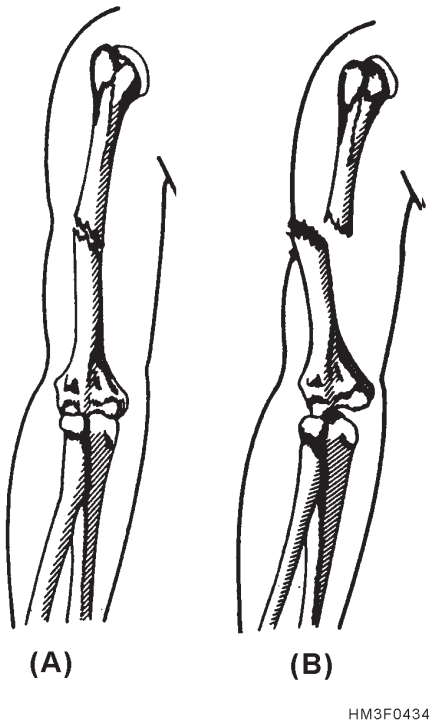


**Figure 4-34.—Fractures: A. Closed; B. Open.**

wobbly movement if the bone is broken clear through. It may be difficult or impossible for the victim to move the injured part; if able to move it, there may be a grating sensation (crepitus) as the ends of the broken bone rub against each other. However, if a bone is cracked rather than broken through, the victim may be able to move the injured part without much difficulty. An open fracture is easy to recognize if an end of the broken bone protrudes through the flesh. If the bone does not protrude, however, you might see the external wound but fail to recognize the broken bone.

### General Guidelines

If you are required to give first aid to a person who has suffered a fracture, you should follow these general guidelines:

- If there is any possibility that a fracture has been sustained, treat the injury as a fracture until an X-ray can be made.
- Get the victim to a definitive care facility at the first possible opportunity. All fractures require medical treatment.
- Do not move the victim until the injured part has been immobilized by splinting (unless the move is necessary to save life or to prevent further injury).

- Treat for shock.
- Do not attempt to locate a fracture by grating the ends of the bone together.
- Do not attempt to set a broken bone unless a medical officer will not be available for many days.
- When a long bone in the arm or leg is fractured, the limb should be carefully straightened so that splints can be applied, unless it appears that further damage will be caused by such a maneuver. Never attempt to straighten the limb by applying force or traction with any improvised device. Pulling gently with your hands along the long axis of the limb is permissible and may be all that is necessary to get the limb back into position.
- Apply splints. If the victim is to be transported only a short distance, or if treatment by a medical officer will not be delayed, it is probably best to leave the clothing on and place emergency splinting over it. However, if the victim must be transported for some distance, or if a considerable period of time will elapse before treatment by a medical officer, it may be better to remove enough clothing so that you can apply well padded splints directly to the injured part. If you decide to remove clothing over the injured part, cut the clothing or rip it along the seams. In any case, **be careful**! Rough handling of the victim may convert a closed fracture into an open fracture, increase the severity of shock, or cause extensive damage to the blood vessels, nerves, muscles, and other tissues around the broken bone.
- If the fracture is open, you must take care of the wound before you can deal with the fracture. Bleeding from the wound may be profuse, but most bleeding can be stopped by direct pressure on the wound. Other supplemental methods of hemorrhage control are discussed in the section on wounds of this chapter. Use a tourniquet as a last resort. After you have stopped the bleeding, treat the fracture.

Now that we have seen the general rules for treating fractures, we turn to the symptoms and emergency treatment of specific fracture sites.

### Forearm Fracture

There are two long bones in the forearm, the radius and the ulna. When both are broken, the arm usually appears to be deformed. When only one is broken, the other acts as a splint and the arm retains a more or less natural appearance. Any fracture of the forearm is likely to result in pain, tenderness, inability to use the forearm, and a kind of wobbly motion at the point of injury. If the fracture is open, a bone will show through.

If the fracture is open, stop the bleeding and treat the wound. Apply a sterile dressing over the wound. Carefully straighten the forearm. (Remember that rough handling of a closed fracture may turn it into an open fracture.) Apply a pneumatic splint if available; if not, apply two well-padded splints to the forearm, one on the top and one on the bottom. Be sure that the splints are long enough to extend from the elbow to the wrist. Use bandages to hold the splints in place. Put the forearm across the chest. The palm of the hand should be turned in, with the thumb pointing upward. Support the forearm in this position by means of a wide sling and a cravat bandage, as shown in figure 4-35. The hand should be raised about 4 inches above the level of the elbow. Treat the victim for shock and evacuate as soon as possible.

### Upper Arm Fracture

The signs of fracture of the upper arm include pain, tenderness, swelling, and a wobbly motion at the point

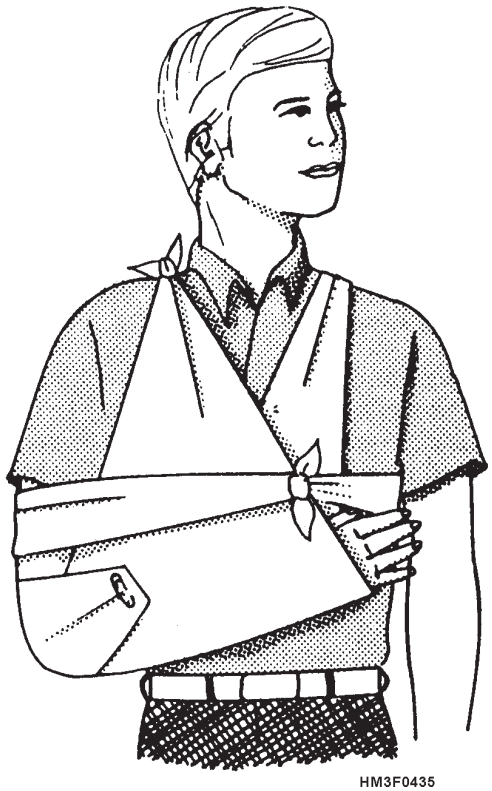


**Figure 4-35.—First aid for a fractured forearm.**

of fracture. If the fracture is near the elbow, the arm is likely to be straight with no bend at the elbow.

If the fracture is open, stop the bleeding and treat the wound before attempting to treat the fracture.

**NOTE:** Treatment of the fracture depends partly upon the location of the break.

If the fracture is in the upper part of the arm near the shoulder, place a pad or folded towel in the armpit, bandage the arm securely to the body, and support the forearm in a narrow sling.

If the fracture is in the middle of the upper arm, you can use one well-padded splint on the outside of the arm. The splint should extend from the shoulder to the elbow. Fasten the splinted arm firmly to the body and support the forearm in a narrow sling, as shown in figure 4-36.

Another way of treating a fracture in the middle of the upper arm is to fasten two wide splints (or four narrow ones) about the arm and then support the forearm in a narrow sling. If you use a splint between the arm and the body, be very careful that it does not extend too far up into the armpit; a splint in this position can cause a dangerous compression of the blood vessels and nerves and may be extremely painful to the victim.

If the fracture is at or near the elbow, the arm may be either bent or straight. No matter in what position you find the arm, **DO NOT ATTEMPT TO STRAIGHTEN IT OR MOVE IT IN ANY WAY**. Splint the arm as carefully as possible in the position in which you find it. This will prevent further nerve and blood vessel damage. The only exception to this is if there is no pulse distal to the fracture, in which case gentle traction is applied and then the arm is splinted. Treat the victim for shock and get him under the care of a medical officer as soon as possible.

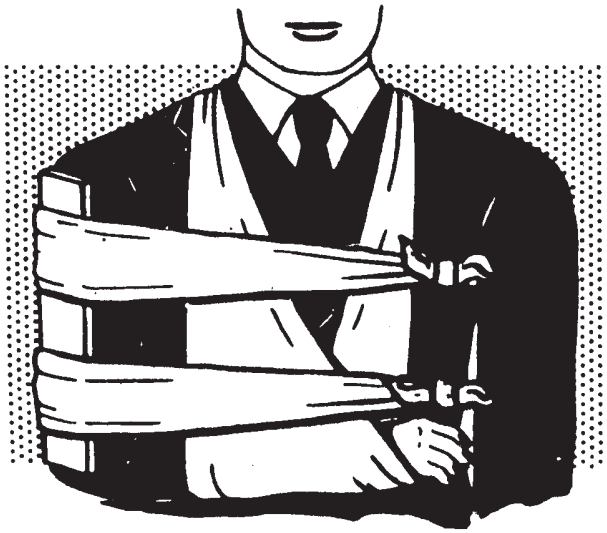


**Figure 4-36.—Splint and sling for a fractured upper arm.**

### Thigh Fracture

The femur is the long bone of the upper part of the leg between the kneecap and the pelvis. When the femur is fractured through, any attempt to move the limb results in a spasm of the muscles and causes excruciating pain. The leg has a wobbly motion, and there is complete loss of control below the fracture. The limb usually assumes an unnatural position, with the toes pointing outward. By actual measurement, the fractured leg is shorter than the uninjured one because of contraction of the powerful thigh muscles. Serious damage to blood vessels and nerves often results from a fracture of the femur, and shock is likely to be severe.

If the fracture is open, stop the bleeding and treat the wound before attempting to treat the fracture itself. Serious bleeding is a special danger in this type of injury, since the broken bone may tear or cut the large artery in the thigh.

Carefully straighten the leg. Apply two splints, one on the outside of the injured leg and one on the inside. The outside splint should reach from the armpit to the foot. The inside splint should reach from the crotch to the foot. The splints should be fastened in five places: (1) around the ankle; (2) over the knee; (3) just below the hip; (4) around the pelvis; and (5) just below the armpit (fig. 4-37). The legs can then be tied together to support the injured leg as firmly as possible.

It is essential that a fractured thigh be splinted before the victim is moved. Manufactured splints, such as the Hare or the Thomas half-ring traction splints, are best, but improvised splints may be used. Figure 4-37 shows how boards may be used as an emergency splint for a fractured thigh. Remember, **DO NOT MOVE THE VICTIM UNTIL THE INJURED LEG HAS BEEN IMMOBILIZED**. Treat the victim for shock, and evacuate at the earliest possible opportunity.

### Lower Leg Fracture

When both bones of the lower leg are broken, the usual signs of fracture are likely to be present. When only one bone is broken, the other one acts as a splint and, to some extent, prevents deformity of the leg. However, tenderness, swelling, and pain at the point of

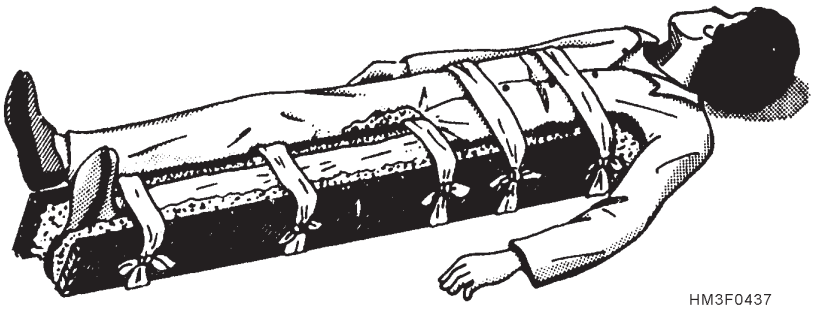


**Figure 4-37.—Splint for a fractured femur.**

fracture are almost always present. A fracture just above the ankle is often mistaken for a sprain. If both bones of the lower leg are broken, an open fracture is very likely to result.

If the fracture is open, stop the bleeding and treat the wound. Carefully straighten the injured leg. Apply a pneumatic splint if available; if not, apply **three** splints, one on each side of the leg and one underneath. Be sure that the splints are well padded, particularly under the knee and at the bones on each side of the ankle.

A pillow and two side splints work very well for treatment of a fractured lower leg. Place the pillow beside the injured leg, then carefully lift the leg and place it in the middle of the pillow. Bring the edges of the pillow around to the front of the leg and pin them together. Then place one splint on each side of the leg (over the pillow), and fasten them in place with strips of bandage or adhesive tape. Treat the victim for shock and evacuate as soon as possible. When available, you may use the Hare or Thomas half-ring traction splints.

### Kneecap Fracture

The following first aid treatment should be given for a fractured kneecap (patella):

Carefully straighten the injured limb. Immobilize the fracture by placing a padded board under the injured limb. The board should be at least 4 inches wide and should reach from the buttock to the heel. Place extra padding under the knee and just above the heel, as shown in figure 4-38. Use strips of bandage to fasten the leg to the board in four places: (1) just below the knee; (2) just above the knee; (3) at the ankle; and (4) at the thigh. **Do not cover the knee itself**. Swelling is likely to occur very rapidly, and any bandage or tie fastened over the knee would quickly become too tight. Treat the victim for shock and evacuate as soon as possible.

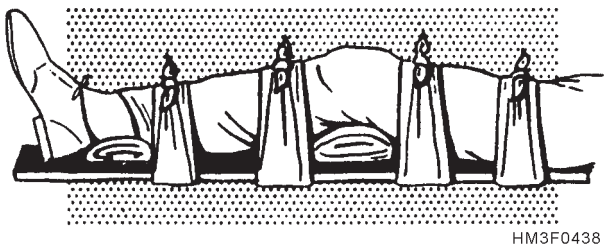


**Figure 4-38.—Immobilization of a fractured patella.**

### Clavicle Fracture

A person with a fractured clavicle usually shows definite symptoms. When the victim stands, the injured shoulder is lower than the uninjured one. The victim is usually unable to raise the arm above the level of the shoulder and may attempt to support the injured shoulder by holding the elbow of that side in the other hand. This is the characteristic position of a person with a broken clavicle. Since the clavicle lies immediately under the skin, you may be able to detect the point of fracture by the deformity and localized pain and tenderness.

If the fracture is open, stop the flow of blood and treat the wound before attempting to treat the fracture. Then apply a sling and swathe splint as described below (and illustrated in figure 4-39).

Bend the victim's arm on the injured side, and place the forearm across the chest. The palm of the hand should be turned in, with the thumb pointed up. The hand should be raised about 4 inches above the level of the elbow. Support the forearm in this position by means of a wide sling. A wide roller bandage (or any wide strip of cloth) may be used to secure the victim's arm to the body (see figure 4-35). A figure-eight bandage may also be used for a fractured clavicle. Treat the victim for shock and evacuate to a definitive care facility as soon as possible.

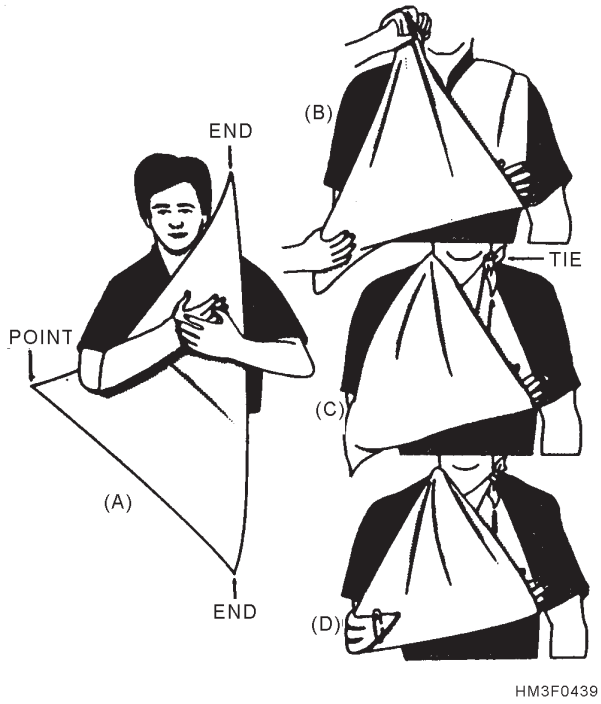


**Figure 4-39.—Sling for immobilizing fractured clavicle.**

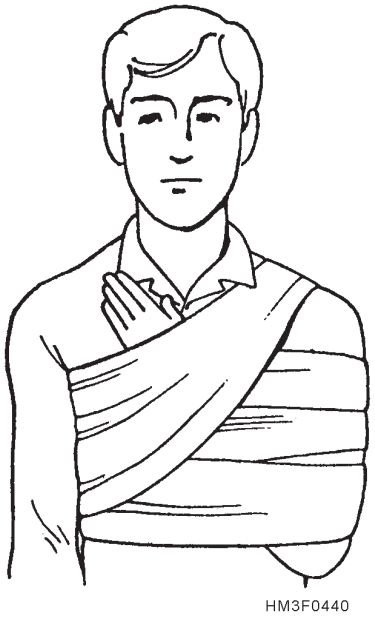


**Figure 4-40.—Swathe bandage of fractured rib victim.**

### Rib Fracture

If a rib is broken, make the victim comfortable and quiet so that the greatest danger—the possibility of further damage to the lungs, heart, or chest wall by the broken ends—is minimized.

The common finding in all victims with fractured ribs is pain localized at the site of the fracture. By asking the patient to point out the exact area of the pain, you can often determine the location of the injury. There may or may not be a rib deformity, chest wall contusion, or laceration of the area. Deep breathing, coughing, or movement is usually painful. The patient generally wishes to remain still and may often lean toward the injured side, with a hand over the fractured area to immobilize the chest and to ease the pain.

Ordinarily, rib fractures are **not** bound, strapped, or taped if the victim is reasonably comfortable. However, they may be splinted by the use of external support. If the patient is considerably more comfortable with the chest immobilized, the best method is to use a swathe (fig. 4-40) in which the arm on the injured side is strapped to the chest to limit motion. Place the arm on the injured side against the chest, with the palm flat, thumb up, and the forearm raised to a 45° angle. Immobilize the chest, using wide strips of bandage to secure the arm to the chest.

Do not use wide strips of adhesive plaster applied directly to the skin of the chest for immobilization since the adhesive tends to limit the ability of the chest to expand (interfering with proper breathing). Treat the victim for shock and evacuate as soon as possible.

### Nose Fracture

A fracture of the nose usually causes localized pain and swelling, a noticeable deformity of the nose, and extensive nosebleed.

Stop the nosebleed. Have the victim sit quietly, with the head tipped slightly backward. Tell the victim to breathe through the mouth and not to blow the nose. If the bleeding does not stop within a few minutes, apply a cold compress or an ice bag over the nose.

Treat the victim for shock. Ensure the victim receives a medical officer's attention as soon as possible. Permanent deformity of the nose may result if the fracture is not treated promptly.

### Jaw Fracture

A person who has a fractured jaw may suffer serious interference with breathing. There is likely to be great difficulty in talking, chewing, or swallowing. Any movement of the jaw causes pain. The teeth may be out of line, and there may be bleeding from the gums. Considerable swelling may develop.

One of the most important phases of emergency care is to clear the upper respiratory passage of any obstruction. If the fractured jaw interferes with breathing, pull the lower jaw and the tongue well **forward** and keep them in that position.

Apply a four-tailed bandage, as shown in figure 4-41. Be sure that the bandage pulls the lower jaw **forward**. Never apply a bandage that forces the jaw backward, since this might seriously interfere with breathing. The bandage must be firm so that it will support and immobilize the injured jaw, but it must not press against the victim's throat. Be sure that the victim has scissors or a knife to cut the bandage in case of vomiting. Treat the victim for shock and evacuate as soon as possible.

**Skull Fracture**

When a person suffers a head injury, the greatest danger is that the brain may be severely damaged; whether or not the skull is fractured is a matter of secondary importance. In some cases, injuries that fracture the skull do not cause serious brain damage; but brain damage can—and frequently does—result from apparently slight injuries that do not cause damage to the skull itself.

It is often difficult to determine whether an injury has affected the brain because the symptoms of brain damage vary greatly. A person suffering from a head injury must be handled very carefully and given immediate medical attention.

Some of the symptoms that may indicate brain damage are listed below. However, you must remember that all of these symptoms are not always present in any one case and that the symptoms that do occur may be greatly delayed.

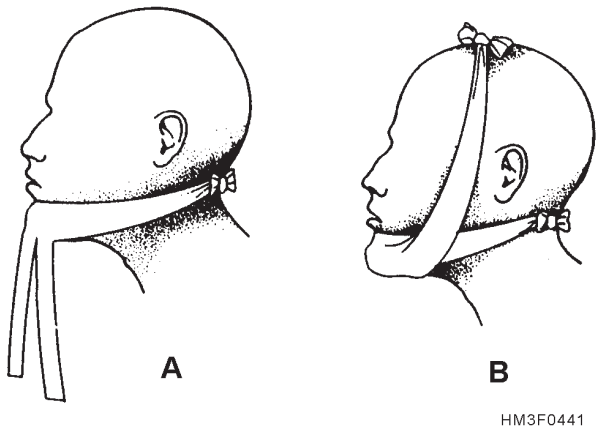


**Figure 4-41.—Four-tailed bandage for the jaw.**

- Bruises or wounds of the scalp may indicate that the victim has sustained a blow to the head. Sometimes the skull is depressed (caved in) at the point of impact. If the fracture is open, you may find glass, shrapnel, or other objects penetrating the skull.
- The victim may be conscious or unconscious. If conscious, the victim may feel dizzy and weak, as though about to faint.
- Severe headache sometimes (but not always) accompanies head injuries.
- The pupils of the eyes may be unequal in size and may not react normally to light.
- There may be bleeding from the ears, nose, or mouth.
- The victim may vomit.
- The victim may be restless and perhaps confused and disoriented.
- The arms, legs, face, or other parts of the body may be partially paralyzed.
- The victim's face may be very pale, or it may be unusually flushed.
- The victim is likely to be suffering from shock, but the symptoms of shock may be disguised by other symptoms.

It is not necessary to determine if the skull is fractured when you are giving first aid to a person who has suffered a head injury. The treatment is the same in either case, and the primary intent is to prevent further damage to the brain.

Keep the victim lying down. If the face is flushed, raise the head and shoulders slightly. If the face is pale, have the victim lie so that the head is level with, or slightly lower than, the body. Watch carefully for vomiting. If the victim begins to vomit, position the head to prevent choking on the vomitus.

If there is serious bleeding from the wounds, try to control that bleeding by the application of direct pressure, using caution to avoid further injury to the skull or brain. Use a donut-shaped bandage to gently surround protruding objects. Never manipulate those objects.

- Be very careful about moving or handling the victim. Move the victim no more than is

necessary. If transportation is necessary, keep the victim lying down.

- In any significant head or facial injury, assume injury to the cervical spine. Immobilization of the cervical spine is indicated.
- Be sure that the victim is kept comfortably warm, but not too warm.
- **Do not** give the victim anything to drink. **DO NOT GIVE ANY MEDICATIONS**. See that the victim receives a medical officer's attention as soon as possible.

**Spinal Fractures**

If the spine is fractured at any point, the spinal cord may be crushed, cut, or otherwise damaged so severely that death or paralysis will result. However, if the fracture occurs in such a way that the spinal cord is not seriously damaged, there is a very good chance of complete recovery, **provided** that the victim is properly cared for. Any twisting or bending of the neck or back—whether due to the original injury or carelessness from handling later—is likely to cause irreparable damage to the spinal cord.

The primary symptoms of a fractured spine are pain, shock, and paralysis. **Pain** is likely to be acute at the point of fracture. It may radiate to other parts of the body. **Shock** is usually severe, but (as in all injuries) the symptoms may be delayed for some time. **Paralysis** occurs if the spinal cord is seriously damaged. If the victim cannot move the legs, feet, or toes, the fracture is probably in the back; if the fingers will not move, the neck is probably broken. Remember that a spinal fracture does not always injure the spinal cord, so the victim is not always paralyzed. Any person who has an acute pain in the back or the neck following an injury should be treated as though there is a fractured spine, even if there are no other symptoms.

Emergency treatment for all spinal fractures, whether of the neck or of the back, has two primary purposes: (1) to minimize shock, and (2) to prevent further injury to the spinal cord. Keep the victim comfortably warm. Do not attempt to keep the victim in the position ordinarily used for the treatment of shock, because it might cause further damage to the spinal cord. Just keep the victim lying flat and do **NOT** attempt to lower the head.

To avoid further damage to the spinal cord, **DO NOT MOVE THE VICTIM UNLESS IT IS ABSOLUTELY ESSENTIAL!** If the victim's life is threatened in the present location or transportation is necessary to receive medical attention, then, of course, you must move the victim. However, if movement is necessary, be sure that you do it in a way that will cause the least possible damage. **DO NOT BEND OR TWIST THE VICTIM'S BODY, DO NOT MOVE THE HEAD FORWARD, BACKWARD, OR SIDEWAYS, AND DO NOT UNDER ANY CIRCUMSTANCES ALLOW THE VICTIM TO SIT UP**.

If it is necessary to transport a person who has suffered a fracture of the spine, follow these general rules:

- If the spine is broken at the **neck**, the victim must be transported lying on the back, **face up.** Place pillows or sandbags beside the head so that it cannot turn to either side. **DO NOT** put pillows or padding under the neck or head.
- If you suspect that the spine is fractured but do not know the location of the break, treat the victim as though the neck is broken (i.e., keep the victim supine). If both the neck and the back are broken, keep the victim supine.
- No matter where the spine is broken, **use a firm support in transporting the victim.** Use a rigid stretcher, or a door, shutter, wide board, etc. Pad the support carefully, and put blankets both under and over the victim. Use cravat bandages or strips of cloth to secure the victim firmly to the support.
- When placing the victim on a spineboard, one of two acceptable methods may be used. However, **DO NOT ATTEMPT TO LIFT THE VICTIM UNLESS YOU HAVE ADEQUATE ASSISTANCE**. Remember: Any bending or twisting of the body is almost sure to cause serious damage to the spinal cord. Figure 4-42 shows the straddle-slide method. One person lifts and supports the head while two other persons each lift at the shoulders and hips, respectively. A fourth person slides the spineboard under the patient. Figure 4-43 shows the proper procedure in performing the log-roll method. The victim is rolled as a single unit towards the rescuers, the spineboard is positioned, and the victim is rolled back onto the spineboard and secured in place. If there are at least four (preferably six) people present to help lift the victim, they can accomplish the job without too much movement of the victim's

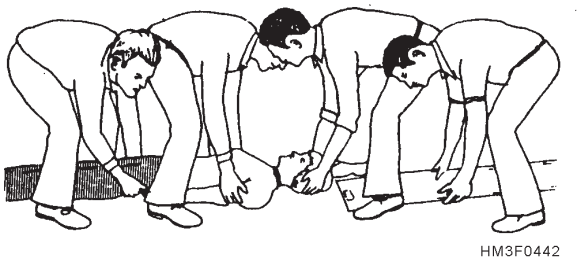


**Figure 4-42.—Straddle-slide method of moving spinal cord injury victim onto a backboard.**

body. **NEVER** attempt to lift the victim, however, with fewer than four people.

- Evacuate the victim very carefully.

### Pelvic Fracture

Fractures in the pelvic region often result from falls, heavy blows, and accidents that involve crushing. The great danger in a pelvic fracture is that the organs enclosed and protected by the pelvis may be seriously damaged when the bony structure is fractured. In particular, there is danger that the bladder will be ruptured. There is also danger of severe internal bleeding; the large blood vessels in the pelvic region may be torn or cut by fragments of the broken bone.

The primary symptoms of a fractured pelvis are severe pain, shock, and loss of ability to use the lower part of the body. The victim is unable to sit or stand. If the victim is conscious, there may be a sensation of "coming apart." If the bladder is injured, the victim's urine may be bloody.

**Do not move the victim unless ABSOLUTELY necessary**. The victim should be treated for shock and

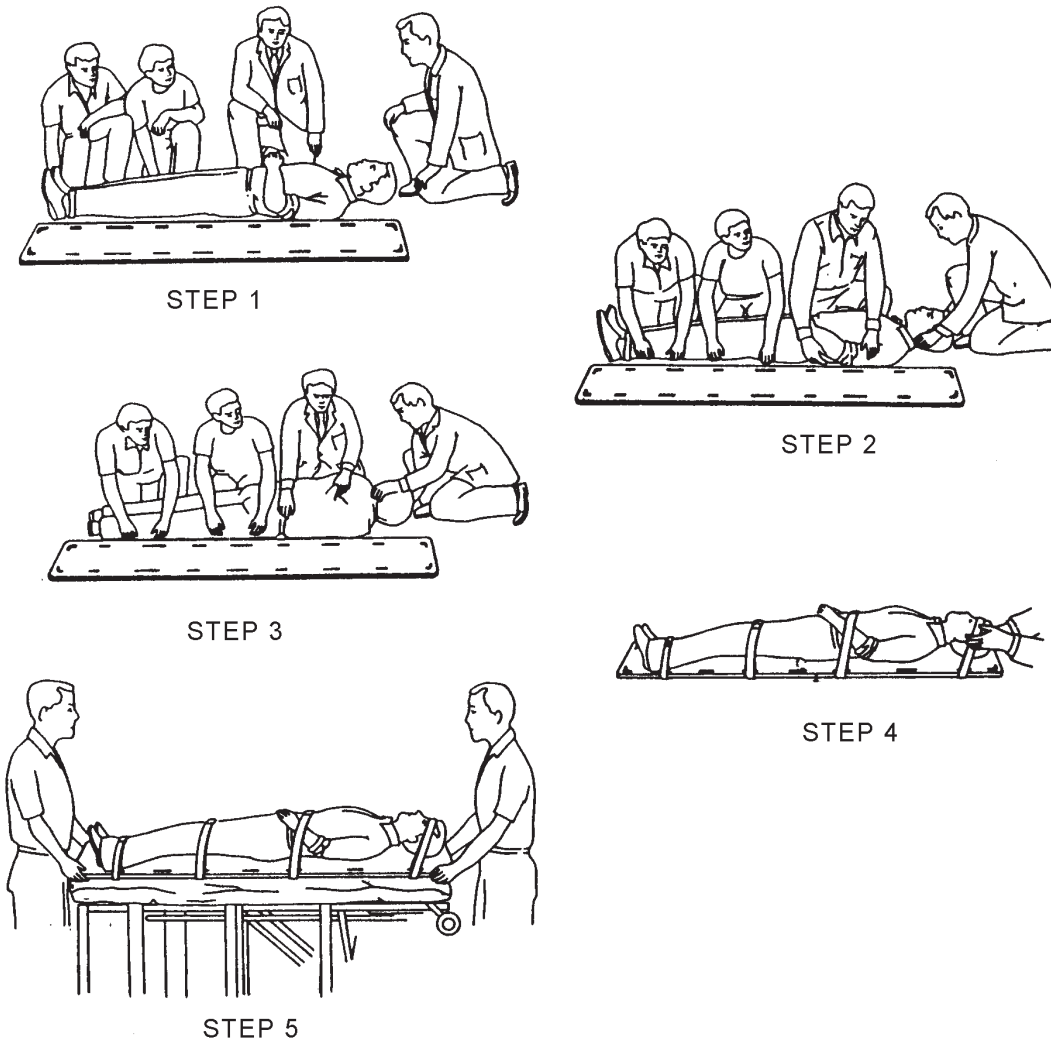


**Figure 4-43.—Log-roll method of moving spinal cord injury victim onto a backboard.**

kept warm but should not be moved into the position ordinarily used for the treatment of shock.

If you must transport the victim to another place, do it with the utmost care. Use a rigid stretcher, a padded door, or a wide board. Keep the victim supine. In some cases, the victim will be more comfortable if the legs are straight, while in other cases the victim will be more comfortable with the knees bent and the legs drawn up. When you have placed the victim in the most comfortable position, immobilization should be accomplished. Fractures of the hip are best treated with traction splints. Adequate immobilization can also be obtained by placing pillows or folded blankets between the legs as shown in figure 4-44 and using cravats, roller bandages, or straps to hold the legs together, or through the use of MAST garments. Fasten the victim securely to the stretcher or improvised support, and evacuate very carefully.

## MANAGEMENT OF JOINT AND MUSCLE INJURIES

**LEARNING OBJECTIVE:** *Select the appropriate stabilization and treatment procedure for the management of joint and muscle injuries.*

Injuries to joints and muscles often occur together, and it is sometimes difficult to tell whether the primary injury is to a joint or to the muscles, tendons, blood vessels, or nerves near the joint. Sometimes it is difficult to distinguish joint or muscle injuries from fractures. In case of doubt, **always** treat any injury to a bone, joint, or muscle as though it were a fracture.

In general, joint and muscle injuries may be classified under four headings: (1) dislocations, (2) sprains, (3) strains, and (4) contusions (bruises).

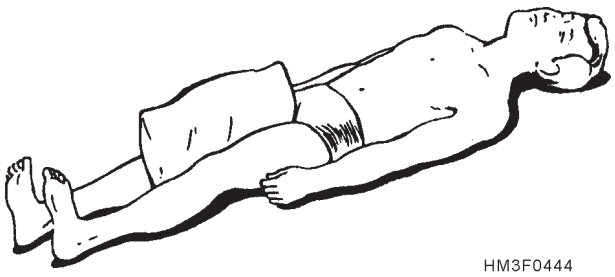


**Figure 4-44.—Immobilizing a fractured pelvis.**

### Dislocations

When a bone is forcibly displaced from its joint, the injury is known as a **dislocation**. In some cases, the bone slips back quickly into its normal position, but at other times it becomes locked in the new position and remains dislocated until it is put back into place. Dislocations are usually caused by falls or blows but occasionally by violent muscular exertion. The most frequently dislocated joints are those of the shoulder, hip, fingers, and jaw.

A dislocation is likely to bruise or tear the muscles, ligaments, blood vessels, tendons, and nerves near a joint. Rapid swelling and discoloration, loss of ability to use the joint, severe pain and muscle spasms, possible numbness and loss of pulse below the joint, and shock are characteristic symptoms of dislocations. The fact that the injured part is usually stiff and immobile, with marked deformation at the joint, will help you distinguish a dislocation from a fracture. In a fracture, there is deformity **between** joints rather than **at** joints, and there is generally a wobbly motion of the broken bone at the point of fracture.

As a general rule, you should **not** attempt to reduce a dislocation—that is, put a dislocated bone back into place—unless you know that a medical officer cannot be reached within 8 hours. Unskilled attempts at reduction may cause great damage to nerves and blood vessels or actually fracture the bone. Therefore, except in great emergencies, you should leave this treatment to specially trained medical personnel and concentrate your efforts on making the victim as comfortable as possible under the circumstances.

The following emergency measures will be helpful:

1. Loosen the clothing around the injured part.
2. Place the victim in the most comfortable position possible.
3. Support the injured part by means of a sling, pillows, bandages, splints, or any other device that will make the victim comfortable.
4. Treat the victim for shock.
5. Get medical help as soon as possible.

You should **NEVER** attempt to reduce the more serious dislocations, such as those of the hip. However, if it is probable that the victim cannot be treated by a medical officer within a **reasonable time**, you should make a careful effort to reduce certain

dislocations (such as those of the jaw, finger, or shoulder) if there is no arterial or nerve involvement (pulse will be palpable and there will be no numbness below the joint). Treat all other dislocations as fractures, and evacuate the victim to a definitive care facility.

**DISLOCATION OF THE JAW**.—When the lower jaw is dislocated, the victim cannot speak or close the mouth. Dislocation of the jaw is usually caused by a blow to the mouth; sometimes it is caused by yawning or laughing. This type of dislocation is not always easy to reduce, and there is considerable danger that the operator's thumbs will be bitten in the process. For your own protection, wrap your thumbs with a handkerchief or bandage. While facing the victim, press your thumbs down just behind the last lower molars and, at the same time, lift the chin up with your fingers. The jaw should snap into place at once. You will have to remove your thumbs quickly to avoid being bitten. No further treatment is required, but you should warn the victim to keep the mouth closed as much as possible during the next few hours. Figure 4-45 shows the position you must assume to reduce a dislocated jaw.

**DISLOCATION OF THE FINGER**.—The joints of the finger are particularly susceptible to injury, and even minor injuries may result in prolonged loss of function. Great care must be used in treating any injury of the finger.

To reduce a dislocation of the finger, grasp the finger firmly and apply a steady pull in the same line as the deformity. If it does not slip into position, try it again, but if it does not go into position on the third attempt, **DO NOT TRY AGAIN**. In any case, and whether or not the dislocation is reduced, the finger should be strapped, slightly flexed, with an aluminum splint or with a roller gauze bandage over a tongue blade. Figure 4-46 shows how a dislocated finger can be immobilized by strapping it to a flat, wooden stick, such as a tongue depressor.

**DISLOCATION OF THE SHOULDER**.—Before reduction, place the victim in a supine position. After putting the heel of your foot in the victim's armpit, grasp the wrist and apply steady traction by pulling gently and increasing resistance gradually. Pull the arm in the same line as it is found. After several minutes of steady pull, flex the victim's elbow slightly. Grasp the arm below the elbow, apply traction from the point of the elbow, and gently rotate the arm into the external or outward position. If three reduction attempts fail, carry the forearm across the chest and apply a sling and swathe. An alternate method involves having the patient lie face down on an examining table with the injured arm hanging over the side. Apply prolonged, firm, gentle traction at the wrist with gentle external rotation. A water bucket with a padded handle placed in the crook of the patient's elbow may be substituted. Gradually add sand or water to the bucket to increase traction. Grasping the wrist and using the elbow as a pivot point, gently rotate the arm into the external position.

### Sprains

Sprains are injuries to the ligaments and soft tissues that support a joint. A sprain is caused by the violent wrenching or twisting of the joint beyond its normal limits of movement and usually involves a momentary dislocation, with the bone slipping back into place of its own accord. Although any joint may

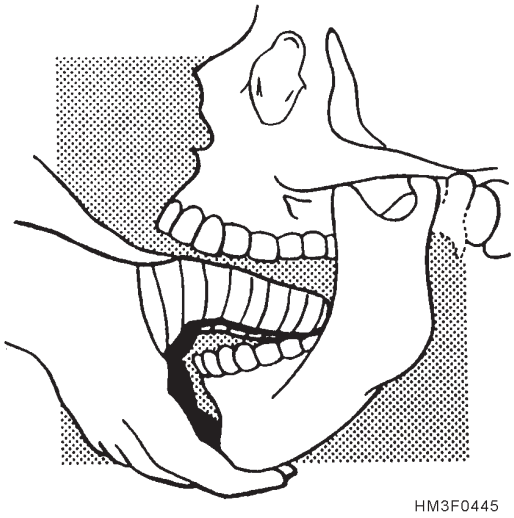


**Figure 4-45.—Position for reducing a dislocated jaw.**

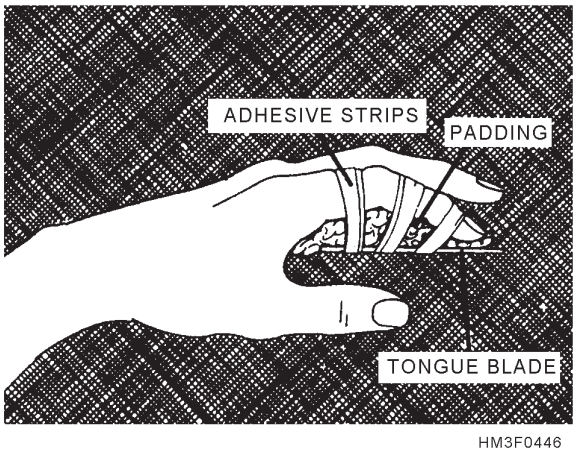


**Figure 4-46.—Immobilizing a dislocated finger.**

be sprained, sprains of the ankle, wrist, knee, and finger are most common.

Symptoms of a sprain include pain or pressure at the joint, pain upon movement, swelling and tenderness, possible loss of movement, and discoloration. Treat all sprains as fractures until ruled out by X-rays.

Emergency care for a sprain includes application of cold packs for the first 24 to 48 hours to reduce swelling and to control internal hemorrhage; elevation and rest of the affected area; application of a snug, smooth, figure-eight bandage to control swelling and to provide immobilization (basket weave adhesive bandages can be used on the ankle); a follow-up examination by a medical officer; and X-rays to rule out the presence of a fracture.

**NOTE:** Check bandaged areas regularly for swelling that might cause circulation impairment and loosen bandages if necessary.

After the swelling stops (24 to 48 hours), moist heat can be applied for short periods (15 to 30 minutes) to promote healing and reduce swelling. Moist heat can be warm, wet compresses, warm whirlpool baths, etc.

**CAUTION:** Heat should not be applied until 24 hours after the last cold pack.

### Strains

Injuries caused by the forcible overstretching or tearing of muscles or tendons are known as **strains**. Strains may be caused by lifting excessively heavy loads, sudden or violent movements, or any other action that pulls the muscles beyond their normal limits.

The chief symptoms of a strain are pain, lameness or stiffness (sometimes involving knotting of the muscles), moderate swelling at the place of injury, discoloration due to the escape of blood from injured blood vessels into the tissues, possible loss of power, and a distinct gap felt at the site.

Keep the affected area elevated and at rest. Apply cold packs for the first 24 to 48 hours to control hemorrhage and swelling. After the swelling stops, apply mild heat to increase circulation and aid in healing. As in sprains, heat should not be applied until 24 hours after the last cold pack. Muscle relaxants, adhesive straps, and complete immobilization of the area may be indicated. Evacuate the victim to a medical facility where X-rays can be taken to rule out the presence of a fracture.

### Contusions

**Contusions**, commonly called bruises, are responsible for the discoloration that almost always accompanies injuries to bones, joints, and muscles. Contusions are caused by blows that damage bones, muscles, tendons, blood vessels, nerves, and other body tissues. They do not necessarily break the skin.

The symptoms of a contusion or bruise are familiar to everyone. There is immediate pain when the blow is received. Swelling occurs because blood from the broken vessels leaks into the soft tissue under the skin. At first the injured place is reddened due to local skin irritation from the blow. Later the characteristic "black and blue" marks appear. Perhaps several days later, the skin turns yellowish or greenish before normal coloration returns. The bruised area is usually very tender.

As a rule, slight bruises do not require treatment. However, if the victim has severe bruises, treat for shock. Immobilize the injured part, keep it at rest, and protect it from further injury. Sometimes the victim will be more comfortable if the bruised area is bandaged firmly with an elastic or gauze bandage. If possible, elevate the injured part. A sling may be used for a bruised arm or hand. Pillows or folded blankets may be used to elevate a bruised leg.

## ENVIRONMENTAL INJURIES

**LEARNING OBJECTIVE:** *Recall the classification and evaluation process for burns, and determine the appropriate treatment for each type of burn.*

Under the broad category of environmental injuries, we will consider a number of emergency problems. Exposure to extremes of temperature, whether heat or cold, causes injury to skin, tissues, blood vessels, vital organs, and, in some cases, the whole body. In addition, contact with the sun's rays, electrical current, or certain chemicals causes injuries similar in character to burns.

### THERMAL BURNS

True burns are generated by exposure to extreme heat that overwhelms the body's defensive mechanisms. Burns and scalds are essentially the same injury: Burns are caused by dry heat, and scalds are caused by moist heat. The seriousness of the injury can

be estimated by the depth, extent, and location of the burn, the age and health of the victim, and other medical complications.

### Classification of Severity

Burns are classified according to their depth as first-, second-, and third-degree burns (as shown in figure 4-47).

**FIRST-DEGREE BURN.—**With a first-degree burn, the epidermal layer is irritated, reddened, and tingling. The skin is sensitive to touch and blanches with pressure. Pain is mild to severe, edema is minimal, and healing usually occurs naturally within a week.

**SECOND-DEGREE BURN.—**A second-degree burn is characterized by epidermal blisters, mottled appearance, and a red base. Damage extends into—but not through—the dermis. Recovery usually takes 2 to 3 weeks, with some scarring and depigmentation. This condition is painful. Body fluids may be drawn into the injured tissue, causing edema and possibly a "weeping" fluid (plasma) loss at the surface.

**THIRD-DEGREE BURN**.—A third-degree burn is a full-thickness injury penetrating into muscle and fatty connective tissues, or even down to the bone. Tissues and nerves are destroyed. Shock, with blood in the urine, is likely to be present. Pain will be absent at the burn site if all the area nerve endings are destroyed, and the surrounding tissue (which is less damaged) will be painful. Tissue color will range from white (scalds) to black (charring burns). Although the wound is usually dry, body fluids will collect in the underlying tissue. If the area has not been completely cauterized, significant amounts of fluids will be lost by plasma "weeping" or by hemorrhage, thus reducing circulation volume. There is considerable scarring and possible loss of function. Skin grafts may be necessary.

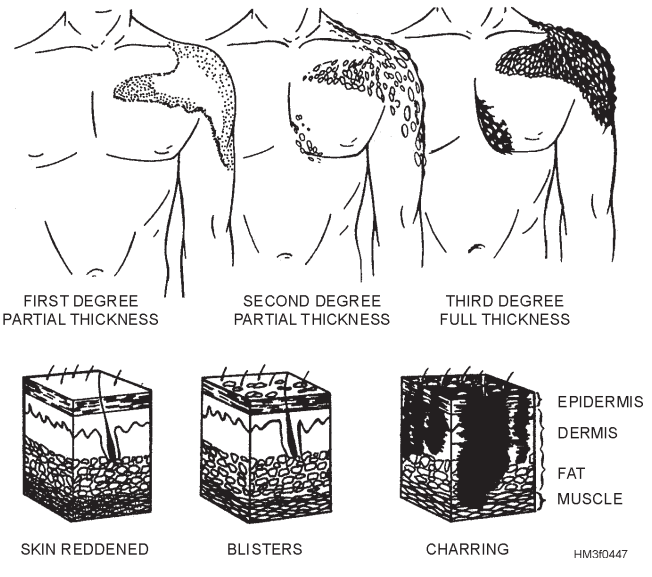


**Figure 4-47.—Classification of burns.**

### Rule of Nines

Of greater importance than the depth of the burn in evaluating the seriousness of the condition is the extent of the burned area. A first-degree burn over 50 percent of the body surface area (BSA) may be more serious than a third-degree burn over 3 percent. The **Rule of Nines** is used to give a rough estimate of the surface area affected. Figure 4-48 shows how the rule is applied to adults.

### Other Factors

A third factor in burn evaluation is the location of the burn. Serious burns of the head, hands, feet, or genitals will require hospitalization.

The fourth factor is the presence of any other complications, especially respiratory tract injuries or other major injuries or factors.

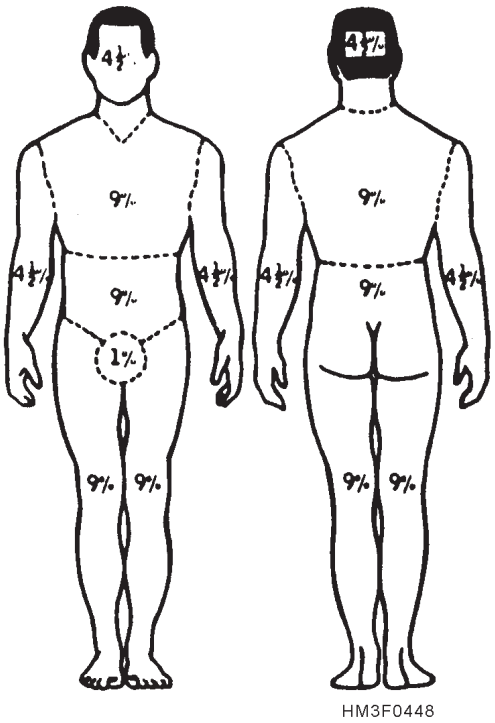


**Figure 4-48.—Rule of Nines.**

The Corpsman must take all these factors into consideration when evaluating the condition of the burn victim, especially in a triage situation.

**First Aid**

After the victim has been removed from the source of the thermal injury, first aid should be kept to a minimum.

- Maintain an open airway.
- Control hemorrhage, and treat for shock.
- Remove constricting jewelry and articles of clothing.
- Protect the burn area from contamination by covering it with clean sheets or dry dressings. **DO NOT** remove clothing adhering to a wound.
- Splint fractures.
- For all serious and extensive burns (over 20 percent BSA), and in the presence of shock, start intravenous therapy with an electrolyte solution (Ringer's lactate) in an unburned area.
- Maintain intravenous treatment during transportation.
- Relieve mild pain with aspirin. Relieve moderate pain with cool, wet compresses or ice water immersion (for burns of less than 20 percent BSA). Severe pain may be relieved with morphine or demerol injections. Pain resulting from small burns may be relieved with an anesthetic ointment if the skin is not broken.

**Aid Station Care**

Once the victim has arrived at the aid station, observe the following procedures.

- Continue to monitor for airway patency, hemorrhage, and shock.
- Continue intravenous therapy that is in place, or start a new one under a medical officer's supervision to control shock and replace fluid loss.
- Monitor urine output.
- Shave body hair well back from the burned area, and then cleanse the area gently with disinfectant soap and warm water. Remove dirt, grease, and nonviable tissue. Apply a sterile dressing of dry gauze. Place bulky dressings around the burned parts to absorb serous exudate.
- All major burn victims should be given a booster dose of tetanus toxoid to guard against infection. Administration of antibiotics may be directed by a medical officer or an Independent Duty Corpsman.
- If evacuation to a definitive care facility will be delayed for 2 to 3 days, start topical antibiotic therapy after the patient stabilizes and following debridement and wound care. Gently spread a 1/16-inch thickness of Sulfamylon® or Silvadene® over the burn area. Repeat the application after 12 hours, and then after daily debridement. Treat minor skin reactions with antihistamines.

**SUNBURN**

Sunburn results from prolonged exposure to the ultraviolet rays of the sun. First- and second-degree burns similar to thermal burns result. Treatment is essentially the same as that outlined for thermal burns. Unless a major percentage of the body surface is affected, the victim will not require more than first aid attention. Commercially prepared sunburn lotions and ointments may be used. Prevention through education and the proper use of sun screens is the best way to avoid this condition.

**ELECTRICAL BURNS**

Electrical burns may be far more serious than a preliminary examination may indicate. The entrance and exit wounds may be small, but as electricity penetrates the skin it burns a large area below the surface, as indicated in figure 4-49. A Corpsman can do little for these victims other than monitoring the basic life functions, delivering CPR, treating for shock if necessary, covering the entrance and exit wounds with a dry, sterile dressing, and transporting the victim to a medical treatment facility.

Before treatment is started, ensure that the victim is no longer in contact with a live electrical source. Shut the power off or use a nonconducting rope or stick to move the victim away from the line or the line away from the victim. See figure 3-26.

**CHEMICAL BURNS**

When acids, alkalies, or other chemicals come in contact with the skin or other body membranes, they

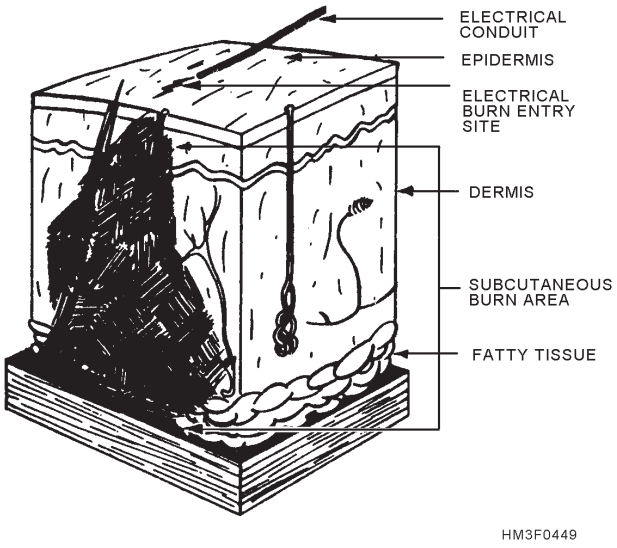


**Figure 4-49.—Electrical burns.**

may cause injuries that are generally referred to as chemical burns. For the most part, these injuries are not caused by heat but by direct chemical destruction of body tissues. Areas most often affected are the extremities, mouth, and eyes. Alkali burns are usually more serious than acid burns because alkalies penetrate deeper and burn longer.

When such burns occur, the following emergency procedures must be carried out immediately:

1. Quickly flush the area with large amounts of water, using a shower or hose, if available. Do not apply water too forcefully. Flood the area while the clothing (including shoes and socks) is being removed and continue often removal.

**NOTE**: There are two exceptions to the above: (1) In alkali burns caused by dry lime, the mixing of water and lime creates a very corrosive substance. Dry lime should be **brushed** away from the skin and clothing, unless large amounts of water are available for rapid and complete flushing. (2) In acid burns caused by phenol (carbolic acid), wash the affected area with alcohol because phenol is not water soluble; then wash with water. If alcohol is not available, flushing with water is better than no treatment at all.

2. After thorough washing, neutralize any chemical remaining on the affected area.

**WARNING: DO NOT** attempt to neutralize a chemical unless you know exactly what it is and what substance will neutralize it. Further damage may be done by a neutralizing agent that is too strong or incorrect.

   For acid burns, make a solution of 1 teaspoon of baking soda to a pint of water and flush it over the affected area. For alkali burns, mix 1 or 2 teaspoons of vinegar to a pint of water and flush it over the affected area.

3. Flush the area again with water and gently pat dry with a sterile gauze. Do not rub the area.

4. Transport the victim to a medical treatment facility.

When treating chemical burns to the eye, the one and only emergency treatment is to flush the eye(s) immediately with large amounts of water or a sterile saline solution. Irrigate acid burns to the eyes for at least 5 to 10 minutes with at least 2000 ml of water. Irrigate alkali burns to the eyes for at least 20 minutes. Because of the intense pain, the victim may be unable to open the eyes. If this occurs, hold the eyelids apart so that water can flow across the eye.

A drinking fountain or field "water buffalo" may be used to supply a steady stream of water. Hold the victim's head in a position that allows water to flow from the inside corner of the eye toward the outside. Do not allow the water to fall directly on the eye, and do not use greater force than is necessary to keep the water flowing across the eye.

**CAUTION**: Never use any chemical antidotes such as baking soda or alcohol in treating burns of the eye, and do not try to neutralize chemical agents.

After thorough irrigation, loosely cover both eyes with a clean dressing. This prevents further damage by decreasing eye movement.

The aftercare for all chemical burns is similar to that for thermal burns: Cover the affected area and get the victim to a medical treatment facility as soon as possible.

## WHITE PHOSPHORUS BURNS

A special category of burns that may affect military personnel in a wartime or training situation is that caused by exposure of white phosphorus (WP or Willy Peter). First aid for this type of burn is

complicated by the fact that white phosphorus particles ignite upon contact with air.

Superficial burns caused by simple skin contact or burning clothes should be flushed with water and treated like thermal burns. Partially embedded white phosphorus particles must be continuously flushed with water while the first aid provider removes them with whatever tools are available (i.e., tweezers, pliers, forceps). Do this quickly, but gently. Firmly or deeply embedded particles that cannot be removed by the first aid provider must be covered with a saline-soaked dressing, and this dressing must be kept wet until the victim reaches a medical treatment facility. The wounds containing embedded phosphorus particles may then be rinsed with a dilute, freshly mixed 1% solution of copper sulfate. This solution combines with phosphorus on the surface of the particles to form a blue-black cupric phosphite covering, which both impedes further oxidation and facilitates identification of retained particles. **Under no circumstances** should the copper sulfate solution be applied as a wet dressing. Wounds must be flushed thoroughly with a saline solution following the copper sulfate rinse to prevent absorption of excessive amounts of copper. (Copper has been associated with extensive intravascular hemolysis.) An adjunct to the management of phosphorus burn injuries is the identification of the retained phosphorescent particles in a darkened room during debridement.

> **NOTE**: Combustion of white phosphorus results in the formation of a severe pulmonary irritant. The ignition of phosphorus in a closed space (such as the BAS tent or sickbay) may result in the development of irritant concentrations sufficient to cause acute inflammatory changes in the tracheobronchial tree. The effects of this gas, especially during debridement, can be minimized by placing a moist cloth over the nose and mouth to inactivate the gas and by ventilating the tent.

## HEAT EXPOSURE INJURIES

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**LEARNING OBJECTIVE:** *Identify the signs, symptoms, and emergency treatment of heat cramps, heat exhaustion, and heat stroke.*

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Excessive heat affects the body in a variety of ways. When a person exercises or works in a hot environment, heat builds up inside the body. The body automatically reacts to get rid of this heat through the sweating mechanism. This depletes water and electrolytes from the circulating volume. If they are not adequately replaced, body functions are affected, and, initially, heat cramps and heat exhaustion develop. If the body becomes too overheated or water or electrolytes too depleted, the sweat-control mechanism of the body malfunctions and shuts down. The result is heat stroke (sunstroke). Heat exposure injuries are a threat in any hot environment, but especially in desert or tropical areas and in the boiler rooms of ships. Under normal conditions, it is a preventable injury. Individual and command awareness of the causes of heat stress problems should help eliminate heat exposure injuries.

### Heat Cramps

Excessive sweating may result in painful cramps in the muscles of the abdomen, legs, and arms. Heat cramps may also result from drinking ice water or other cold drinks either too quickly or in too large a quantity after exercise. Muscle cramps are often an early sign of approaching heat exhaustion.

To provide first aid treatment for heat cramps, move the victim to a cool place. Since heat cramps are caused by loss of salt and water, give the victim plenty of cool (not cold) water to drink, adding about one teaspoon of salt to a liter or quart of water. Apply manual pressure to the cramped muscle, or gently massage it to relieve the spasm. If there are indications of anything more serious, transport the victim immediately to a medical treatment facility.

### Heat Exhaustion

Heat exhaustion (heat prostration or heat collapse) is the most common condition caused by working or exercising in hot environments. In heat exhaustion, there is a serious disturbance of blood flow to the brain, heart, and lungs. This causes the victim to experience weakness, dizziness, headache, nausea, and loss of appetite. The victim may faint but will probably regain consciousness as the head is lowered, which improves the blood supply to the brain. Signs and symptoms of heat exhaustion are similar to those of shock; the victim will appear ashen gray, the skin cool, moist, and clammy and the pupils may be dilated (fig. 4-50). The vital signs usually are normal; however, the victim may have a weak pulse, together with rapid and shallow breathing. Body temperature may be below normal.

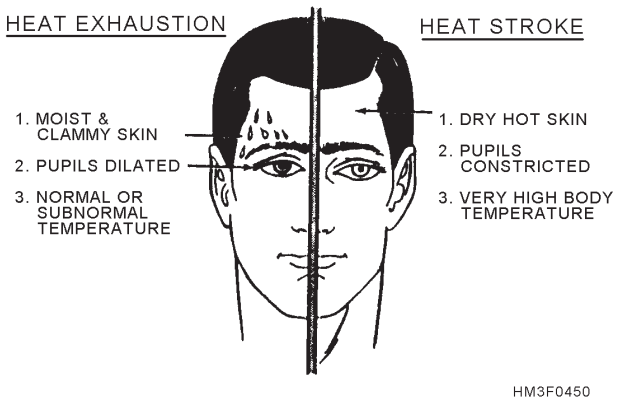


**Figure 4-50.—Heat exhaustion and heat stroke.**

Treat heat exhaustion as if the victim were in shock. Move the victim to a cool or air-conditioned area. Loosen the clothing, apply cool wet cloths to the head, axilla, groin, and ankles, and fan the victim. Do not allow the victim to become chilled. (If this does occur, cover with a light blanket and move into a warmer area.) If the victim is conscious, give a solution of 1 teaspoon of salt dissolved in a liter of cool water. If the victim vomits, do not give any more fluids. Transport the victim to a medical treatment facility as soon as possible. Intravenous fluid infusion may be necessary for effective fluid and electrolyte replacement to combat shock.

### Heat Stroke

Sunstroke is more accurately called heat stroke since it is not necessary to be exposed to the sun for this condition to develop. It is a less common but far more serious condition than heat exhaustion, since it carries a 20 percent mortality rate. The most important feature of heat stroke is the extremely high body temperature (105°F, 41°C or higher) accompanying it. In heat stroke, the victim suffers a breakdown of the sweating mechanism and is unable to eliminate excessive body heat build up while exercising. If the body temperature rises too high, the brain, kidneys, and liver may be permanently damaged.

Sometimes the victim may have preliminary symptoms such as headache, nausea, dizziness, or weakness. Breathing will be deep and rapid at first, later shallow and almost absent. Usually the victim will be flushed, very dry, and very hot. The pupils will be constricted (pinpoint) and the pulse fast and strong (fig. 4-50). Compare these symptoms with those of heat exhaustion.

When providing first aid for heat stroke, remember that this is a true life-and-death emergency. The longer the victim remains overheated, the more likely irreversible brain damage or death will occur. First aid is designed to reduce body heat fast.

Reduce heat immediately by dousing the body with cold water or by applying wet, cold towels to the whole body. Move the victim to the coolest place available and remove as much clothing as possible. Maintain an open airway. Place the victim on his back, with the head and shoulders slightly raised. If cold packs are available, place them under the arms, around the neck, at the ankles, and in the groin. Expose the victim to a fan or air conditioner, since drafts will promote cooling. Immersing the victim in a cold water bath is also very effective. If the victim is conscious, give cool water to drink. **Do not give any hot drinks or stimulants.** Discontinue cooling when the rectal temperature reaches 102°F; watch for recurrence of temperature rise by checking every 10 minutes. Repeat cooling if temperature reaches 103°F rectally.

Get the victim to a medical facility as soon as possible. Cooling measures must be continued while the victim is being transported. Intravenous fluid infusion may be necessary for effective fluid and electrolyte replacement to combat shock.

### Prevention of Heat Exposure Injuries

**LEARNING OBJECTIVE:** *Determine the steps needed to prevent heat exposure injuries.*

The prevention of heat exposure injuries is a command responsibility, but the medical department plays a role in it by educating all hands about the medical dangers, monitoring environmental health, and advising the commanding officer.

On the individual level, prevention centers on water and salt replacement. Sweat must be replaced ounce for ounce; in a hot environment, water consumption must be drastically increased. Salt should be replaced by eating well-balanced meals, three times a day, salted to taste. In the field, "C" rations contain enough salt to sustain a person in most situations. **DO NOT** use salt tablets unless specified by a physician. **DO NOT** consume alcoholic beverages.

At the command level, prevention centers on an awareness of the environment. The Wet Bulb Globe

Temperature (WBGT) must be monitored regularly, and the results interpreted with the Physiological Heat Exposure Limit (PHEL) chart before work assignments are made. In addition, unnecessary heat sources, especially steam leaks, must be eliminated, and vents and exhaust blowers must be checked for adequate circulation. The results will be a happier, healthier, and more productive crew.

## COLD EXPOSURE INJURIES

**LEARNING OBJECTIVE:** *Identify the signs, symptoms, and emergency treatment of each type of cold exposure injury.*

When the body is subjected to extremely cold temperatures, blood vessels constrict, and body heat is gradually lost. As the body temperature drops, tissues are easily damaged or destroyed.

The cold injuries resulting from inadequate response to the cold in military situations have spelled disaster for many armies—those of Napoleon and Hitler in their Russian campaigns, for example. The weather (i.e., temperature, humidity, precipitation, and wind) is the predominant influence in the development of cold injuries. Falling temperature interacting with high humidity, a wet environment, and rising wind accelerates the loss of body heat.

Other factors that influence the development of cold injuries are the individual's level of dehydration, the presence of other injuries (especially those causing a reduction in circulatory flow), and a previous cold injury (which increases susceptibility by lowering resistance). In addition, the use of any drug (including alcohol) that modifies autonomic nervous system response or alters judgment ability can drastically reduce an individual's chance for survival in a cold environment.

Like heat exposure injuries, cold exposure injuries are preventable. Acclimatization, the availability of warm, layered clothing, and maintenance of good discipline and training standards are important factors. These are command—not medical—responsibilities, but the Corpsman plays a crucial role as a monitor of nutritional intake and personal hygiene (with emphasis on foot care) and as an advisor to the commanding officer. A Corpsman is also responsible for acquainting the troops with the dangers of cold exposure and with preventive measures.

Two major points must be stressed in the management of all cold injuries: Rapid rewarming is of primary importance, and all unnecessary manipulations of affected areas must be avoided. More will be said about these points later.

In military operations the treatment of cold injuries is influenced by the tactical situation, the facilities available for the evacuation of casualties, and the fact that most cold injuries are encountered in large numbers during periods of intense combat when many other wounded casualties appear. Highly individualized treatment under these circumstances may be impossible because examination and treatment of more life-endangering wounds must be given priority. In a high-casualty situation, shelter cold-injury victims, and try to protect them from further injury until there is sufficient time to treat them.

All cold injuries are similar, varying only in the degree of tissue damage. Although the effects of cold can, in general, be divided into two types—general cooling of the entire body and local cooling of parts of the body—cold injuries are seldom strictly of one type or the other; rather, these injuries tend to be a combination of both types. Each type of cooling, however, will be discussed separately in the sections that follow.

### General Cooling (Hypothermia)

General cooling of the whole body is caused by continued exposure to low or rapidly falling temperatures, cold moisture, snow, or ice. Those exposed to low temperatures for extended periods may suffer ill effects, even if they are well protected by clothing, because cold affects the body systems slowly, almost without notice. As the body cools, there are several stages of progressive discomfort and disability. The first symptom is shivering, which is an attempt to generate heat by repeated contractions of surface muscles. This is followed by a feeling of listlessness, indifference, and drowsiness. Unconsciousness can follow quickly. Shock becomes evident as the victim's eyes assume a glassy stare, respiration becomes slow and shallow, and the pulse is weak or absent. As the body temperature drops even lower, peripheral circulation decreases and the extremities become susceptible to freezing. Finally, death results as the core temperature of the body approaches 80°F.

The steps for treatment of hypothermia are as follows:

1. Carefully observe respiratory effort and heart beat; CPR may be required while the warming process is underway.

2. Rewarm the victim as soon as possible. It may be necessary to treat other injuries before the victim can be moved to a warmer place. Severe bleeding must be controlled and fractures splinted over clothing before the victim is moved.
3. Replace wet or frozen clothing and remove anything that constricts the victim's arms, legs, or fingers, interfering with circulation.
4. If the victim is inside a warm place and is conscious, the most effective method of warming is immersion in a tub of warm (100° to 105°F or 38° to 41°C) water. The water should be warm to the elbow—never hot. Observe closely for signs of respiratory failure and cardiac arrest (rewarming shock). Rewarming shock can be minimized by warming the body trunk before the limbs to prevent vasodilation in the extremities with subsequent shock due to blood volume shifts.
5. If a tub is not available, apply external heat to both sides of the victim. Natural body heat (skin to skin) from two rescuers is the best method. This is called "buddy warming." If this is not practical, use hot water bottles or an electric rewarming blanket. Do not place the blanket or bottles next to bare skin, however, and be careful to monitor the temperature of the artificial heat source, since the victim is very susceptible to burn injury. Because the victim is unable to generate adequate body heat, placement under a blanket or in a sleeping bag is not sufficient treatment.
6. If the victim is conscious, give warm liquids to drink. Never give alcoholic beverages or allow the victim to smoke.
7. Dry the victim thoroughly if water is used for rewarming.
8. As soon as possible, transfer the victim to a definitive care facility. Be alert for the signs of respiratory and cardiac arrest during transfer, and keep the victim warm.

### Local Cooling

Local cooling injuries, affecting individual parts of the body, fall into two categories: freezing and nonfreezing injuries. In the order of increasing seriousness, they include chilblain, immersion foot, superficial frostbite, and deep frostbite. The areas most commonly affected are the face and extremities.

**CHILBLAIN**.—Chilblain is a mild cold injury caused by prolonged and repeated exposure for several hours to air temperatures from above freezing 32°F (0°C) to as high as 60°F (16°C). Chilblain is characterized by redness, swelling, tingling, and pain to the affected skin area. Injuries of this nature require no specific treatment except warming of the affected part (if possible use a water bath of 90°F to 105°F), keeping it dry, and preventing further exposure.

**IMMERSION FOOT**.—Immersion foot, which also may occur in the hands, results from prolonged exposure to wet cold at temperatures ranging from just above freezing to 50°F (10°C). Immersion foot is usually seen in connection with limited motion of the extremities and water-soaked protective clothing.

Signs and symptoms of immersion foot are tingling and numbness of the affected areas; swelling of the legs, feet, or hands; bluish discoloration of the skin; and painful blisters. Gangrene may occur. General treatment for immersion foot is as follows:

1. Get the victim off his feet as soon as possible.
2. Remove wet shoes, socks, and gloves to improve circulation.
3. Expose the affected area to warm, dry air.
4. Keep the victim warm.
5. **Do not** rupture blisters or apply salves and ointments.
6. If the skin is not broken or loose, the injured part may be left exposed; however, if it is necessary to transport the victim, cover the injured area with loosely wrapped fluff bandages of sterile gauze.
7. If the skin is broken, place a sterile sheet under the extremity and gently wrap it to protect the sensitive tissue from pressure and additional injury.
8. Transport the victim as soon as possible to a medical treatment facility as a litter patient.

**FROSTBITE**.—Frostbite occurs when ice crystals form in the skin or deeper tissues after exposure to a temperature of 32°F (0°C) or lower. Depending upon the temperature, altitude, and wind speed, the exposure time necessary to produce frostbite varies from a few minutes to several hours.

The areas most commonly affected are the face and extremities.

The symptoms of frostbite are progressive. Victims generally incur this injury without being acutely aware of it. Initially, the affected skin reddens and there is an uncomfortable coldness. With continued heat loss, there is a numbness of the affected area due to reduced circulation. As ice crystals form, the frozen extremity appears white, yellow-white, or mottled blue-white, and is cold, hard, and insensitive to touch or pressure. Frostbite is classified as superficial or deep, depending on the extent of tissue involvement.

**Superficial Frostbite**.—In superficial frostbite the surface of the skin will feel hard, but the underlying tissue will be soft, allowing it to move over bony ridges. This is evidence that only the skin and the region just below it are involved. General treatment for superficial frostbite is as follows:

1. Take the victim indoors.
2. Rewarm hands by placing them under the armpits, against the abdomen, or between the legs.
3. Rewarm feet by placing them in the armpit or against the abdomen of the buddy.
4. Gradually rewarm the affected area by warm water immersion, skin-to-skin contact, or hot water bottles.
5. Never rub a frostbite area.

**Deep Frostbite**.—In deep frostbite, the freezing reaches into the deep tissue layers. There are ice crystals in the entire thickness of the extremity. The skin will not move over bony ridges and will feel hard and solid.

The objectives of treatment are to protect the frozen areas from further injury, to rapidly thaw the affected area, and to be prepared to respond to circulatory or respiratory difficulties.

1. Carefully assess and treat any other injuries first. Constantly monitor the victim's pulse and breathing since respiratory and heart problems can develop rapidly. Be prepared to administer CPR if necessary.
2. Do not attempt to thaw the frostbitten area if there is a possibility of refreezing. It is better to leave the part frozen until the victim arrives at a medical treatment facility equipped for long-term care. Refreezing of a thawed extremity causes severe and disabling damage.
3. Treat all victims with injuries to the feet or legs as litter patients. When this is not possible, the victim may walk on the frozen limb, since it has been proven that walking will not lessen the chances of successful treatment as long as the limb has not thawed out.
4. When adequate protection from further cold exposure is available, prepare the victim for rewarming by removing all constricting clothing such as gloves, boots, and socks. Boots and clothing frozen on the body should be thawed by warm-water immersion before removal.
5. Rapidly rewarm frozen areas by immersion in water at 100°F to 105°F (38°C to 41°C). Keep the water warm by adding fresh hot water, but do not pour the water directly on the injured area. Ensure that the frozen area is completely surrounded by water; do not let it rest on the side or bottom of the tub.
6. After rewarming has been completed, pat the area dry with a soft towel. Later it will swell, sting, and burn. Blisters may develop. These should be protected from breaking. Avoid pressure, rubbing, or constriction of the injured area. Keep the skin dry with sterile dressings and place cotton between the toes and fingers to prevent their sticking together.
7. Protect the tissue from additional injury and keep it as clean as possible (use sterile dressings and linen).
8. Try to improve the general morale and comfort of the victim by giving hot, stimulating fluids such as tea or coffee. Do not allow the victim to smoke or use alcoholic beverages while being treated.
9. Transfer to a medical treatment facility as soon as possible. During transportation, slightly elevate the frostbitten area and keep the victim and the injured area warm. Do not allow the injured area to be exposed to the cold.

**Later Management of Cold Injuries**

**LEARNING OBJECTIVE:** *Determine the steps needed for the later management of cold-exposure injuries.*

When the patient reaches a hospital or a facility for definitive care, the following treatment should be employed:

1. Maintain continued vigilance to avoid further damage to the injured tissue. In general, this is accomplished by keeping the patient at bed rest with the injured part elevated (on surgically clean sheets) and with sterile pieces of cotton separating the toes or fingers. Expose all lesions to the air at normal room temperature. Weight bearing on injured tissue must be avoided.
2. Whirlpool baths, twice daily at 98.6°F (37°C) with surgical soap added, assist in superficial debridement, reduce superficial bacterial contamination, and make range of motion exercises more tolerable.
3. Analgesics may be required in the early post-thaw days but will soon become unnecessary in uncomplicated cases.
4. Encourage the patient to take a nutritious diet with adequate fluid intake to maintain hydration.
5. Perform superficial debridement of ruptured blebs, and remove suppurative scabs and partially detached nails.

## MORPHINE USE FOR PAIN RELIEF

**LEARNING OBJECTIVE:** *Recall morphine dosage, administration routes, indications, contraindications, and casualty marking procedures.*

As a Corpsman, you may be issued morphine for the control of shock through the relief of severe pain. You will be issued this controlled drug under very strict accountability procedures. Possession of this drug is a medical responsibility that must not be taken lightly. Policies pertaining to morphine administration are outlined in BUMEDINST 6570.2, *Morphia Dosage and Casualty Marking*.

## MORPHINE ADMINISTRATION

Morphine is the most effective of all pain-relieving drugs. It is most commonly available in premeasured doses in syrettes or tubexes. Proper administration in selected patients relieves distressing pain and assists in preventing shock. The adult dose of morphine is 10 to 20 mg, which may be repeated, if necessary, in no less than 4 hours.

Morphine has several undesirable effects, however, and a Corpsman must thoroughly understand these effects. Morphine

- is a severe respiratory depressant and must not be given to patients in moderate or severe shock or in respiratory distress.
- increases intracranial pressure and may induce vomiting. These effects may be disastrous in head injury cases.
- causes constriction of the pupils (pinpoint pupils). This effect prevents the use of the pupillary reactions for diagnosis in head injuries.
- is cardiotoxic and a peripheral vasodilator. Small doses of morphine may cause profound hypotension in a patient in shock.
- poisoning is always a danger. There is a narrow safety margin between the amounts of morphine that may be given therapeutically and the amounts that produce death.
- causes considerable mental confusion and interferes with the proper exercise of judgment. Therefore, morphine should not be given to ambulatory patients.
- is a highly addictive drug. Morphine should not be given trivially and must be rigidly accounted for. Only under emergency circumstances should the Corpsman administer morphine.

Rigidly control morphine administration to patients in shock or with extensive burns. Because of the reduced peripheral circulation, morphine administration by subcutaneous or intramuscular routes may not be absorbed into the bloodstream, and pain may persist. When pain persists, the uninformed often give additional doses, hoping to bring about relief. When resuscitation occurs and the peripheral circulation improves, the stored quantities of morphine are released into the system, and an extremely serious condition (morphine poisoning) results.

When other pain-relieving drugs are not available and the patient in shock or with burns is in severe pain, 20 mg of morphine may be given intramuscularly (followed by massage of the injection site). Resist the temptation to give more, however. Unless otherwise ordered by a medical officer, doses should not be repeated more than twice, and then at least 4 hours apart.

If the pain from a wound is severe, morphine may be given when examination of the patient reveals no

- head injury;
- chest injury, including sucking and nonsucking wounds;
- wounds of the throat, nasal passages, oral cavity, or jaws wherein blood might obstruct the airway;
- massive hemorrhage;
- respiratory impairment, including chemical burns of the respiratory tract (any casualty having fewer than 16 respirations per minute should not be given morphine);
- evidence of severe or deepening shock; or
- loss of consciousness.

### CASUALTY MARKING

Morphine overdose is always a danger. For this reason, plainly identify every casualty who has received morphine. Write the letter "M" and the hour of injection on the patient's forehead (e.g., M0830) with a skin pencil or semi-permanent marking substitute. Attach the empty morphine syrette or tubex to the patient's shirt collar or another conspicuous area of the clothing with a safety pin or by some other means. This action will alert others that the drug has been administered. If a Field Medical Card is prepared, record the dosage, time, date, and route of administration.

## COMMON MEDICAL EMERGENCIES

**LEARNING OBJECTIVE:** *Choose the appropriate treatment and management techniques for the common medical emergencies.*

This section of the chapter deals with relatively common medical emergencies a Hospital Corpsman may face. Generally speaking, these particular problems are the result of previously diagnosed medical conditions; so, at least for the victim, they do not come as a complete surprise. Many of these victims wear a medical identification device (necklace or bracelet), or carry a medical identification card that specifies the nature of the medical condition or the type of medications being taken. In all cases of sudden illness, search the victim for a medical identification device.

### SYNCOPE

Uncomplicated syncope (fainting) is the result of blood pooling in dilated veins, which reduces the amount of blood being pumped to the brain. Causes of syncope include getting up too quickly, standing for long periods with little movement, and stressful situations. Signs and symptoms that may be present are dizziness; nausea; visual disturbance from pupillary dilation; sweating; pallor; and a weak, rapid pulse. As the body collapses, blood returns to the head, and consciousness is quickly regained. Revival can be promoted by carefully placing the victim in the shock position or in a sitting position with the head between the knees. Placing a cool, wet cloth on the patient's face and loosening their clothing can also help.

Syncope may also result from an underlying medical problem such as diabetes, cerebrovascular accident (stroke), heart condition, or epilepsy.

### DIABETIC CONDITIONS

Diabetes mellitus is an inherited condition in which the pancreas secretes an insufficient amount of the protein hormone insulin. Insulin regulates carbohydrate metabolism by enabling glucose to enter cells for use as an energy source. Diabetics almost always wear a medical identification device.

#### Diabetic Ketoacidosis

Diabetic ketoacidosis most often results either from forgetting to take insulin or from taking too little insulin to maintain a balanced condition. Diabetics may suffer from rising levels of glucose in the blood stream (hyperglycemia). The rising levels of glucose result in osmotic diuresis, an increased renal excretion of urine. Serious dehydration (hypovolemia) may result. Concurrently, the lack of glucose in the cells leads to an increase in metabolic acids in the blood (acidosis) as other substances, such as fats, are metabolized as energy sources. The result is gradual central nervous system depression, starting with symptoms of confusion and disorientation, and leading

to stupor and coma. Blood pressure falls, and the pulse rate becomes rapid and weak. Respirations are deep, and a sickly sweet acetone odor is present on the breath. The skin is warm and dry.

**NOTE:** Diabetic victims are often mistakenly treated as if intoxicated since the signs and symptoms presented are similar to those of alcohol intoxication.

The diabetic under treatment tries to balance the use of insulin against glucose intake to avoid the above problems. The victim or the victim's family may be able to answer two key questions:

1. Has the victim eaten today?
2. Has he taken the prescribed insulin?

If the answer is yes to the first and no to the second question, the victim is probably in a diabetic coma.

Emergency first aid centers around ABC support, administration of oral or intravenous fluids to counter shock, and rapid evacuation to a medical officer's supervision.

### Insulin Shock

Insulin shock results from too little sugar in the blood (hypoglycemia). This type of shock develops when a diabetic exercises too much or eats too little after taking insulin. Insulin shock is a very serious condition because glucose is driven into the cells to be metabolized, leaving too little glucose in circulation to support the brain. Brain damage develops quickly. Signs and symptoms of insulin shock include

- pale, moist skin;
- dizziness and headache;
- strong, rapid pulse; and
- fainting, seizures, and coma.

Treatment is centered on getting glucose into the system quickly to prevent brain damage. Placing sugar cubes under the tongue or administering oral liquid glucose are the most beneficial treatments. Transport the victim to a medical treatment facility as soon as possible.

**NOTE:** If you are in doubt as to whether the victim is in insulin shock or a ketoacidotic state, give them sugar. Brain damage develops very quickly in insulin shock and must be reversed immediately. If the victim turns out to be ketoacidotic, a condition that progresses slowly, the extra sugar will do no appreciable harm.

## CEREBROVASCULAR ACCIDENT

A cerebrovascular accident, also known as **stroke** or **apoplexy**, is caused by an interruption of the arterial blood supply to a portion of the brain. This interruption may be caused by arteriosclerosis or by a clot forming in the brain. Tissue damage and loss of function result.

Onset of a cerebrovascular accident is sudden, with little or no warning. The first signs include weakness or paralysis on the side of the body opposite the side of the brain that has been injured. Muscles of the face on the affected side may be involved. The patient's level of consciousness varies from alert to unresponsive. Additionally, motor functions—including vision and speech—on the affected side are disturbed, and the throat may be paralyzed.

Emergency treatment for a cerebrovascular accident is mainly supportive. Special attention must be paid to the victim's airway, since he may not be able to keep it clear. Place the victim in a semi-reclining position or on the paralyzed side.

- Be prepared to use suction if the victim vomits.
- Act in a calm, reassuring manner, and keep any onlookers quiet since the victim may be able to hear what is going on.
- Administer oxygen to combat cerebral hypoxia.
- Carefully monitor the victim's vital signs and keep a log. Pay special attention to respirations, pulse strength and rate, and the presence or absence of the bilateral carotid pulse.
- Transport the victim to a medical treatment facility as soon as possible.

## ANAPHYLACTIC REACTION

This condition, also called **anaphylaxis** or **anaphylactic shock**, is a severe allergic reaction to foreign material. The most frequent causes are probably penicillin and the toxin from bee stings, although foods, inhalants, and contact substances can also cause a reaction. Anaphylaxis can happen at any time, even to people who have taken penicillin many times before without experiencing any problems. This condition produces severe shock and cardiopulmonary failure of a very rapid onset. Because of the rapidity

and severity of the onset of symptoms, immediate intervention is necessary. The general treatment for severe anaphylaxis is the subcutaneous injection of 0.3 cc of epinephrine and supportive care.

The most characteristic and serious symptoms of an anaphylactic reaction are loss of voice and difficulty breathing. Other typical signs are giant hives, coughing, and wheezing. As the condition progresses, signs and symptoms of shock develop, followed by respiratory failure. Emergency management consists of maintaining vital life functions. Summon the medical officer immediately.

## POISONS/DRUG ABUSE/HAZARDOUS MATERIALS

As a Hospital Corpsman, you could encounter special situations that include poisoning, suspected drug abuse, or exposure to hazardous materials. Knowledge of these conditions—along with the ability to assess and treat them—is essential. These situations are discussed in detail in chapter 5, "Poisoning, Drug Abuse, and Hazardous Material Exposure."

## HEART CONDITIONS

A number of heart conditions are commonly referred to as heart attacks. These conditions include **angina pectoris**, **acute myocardial infarction**, and **congestive heart failure**. Together these heart conditions are the cause of at least half a million deaths per year in our country. Heart conditions occur more commonly in men in the 50-to-60-year age group. Predisposing factors are the lack of physical conditioning, high blood pressure and blood cholesterol levels, smoking, diabetes, and a family history of heart disease.

### Angina Pectoris

Angina pectoris, also known simply as **angina**, is caused by insufficient oxygen being circulated to the heart muscle. This condition results from a spasm of the coronary artery, which allows the heart to function adequately at rest but does not allow enough oxygen-enriched blood to pass through the heart to support sustained exercise. When the body exerts itself, the heart muscle becomes starved for oxygen. The result of this condition is a squeezing, substernal pain that may radiate to the left arm and to the jaw.

Angina is differentiated from other forms of heart problems because the pain results from exertion and subsides with rest. Many people who suffer from angina pectoris carry nitroglycerin tablets. If the victim of a suspected angina attack is carrying a bottle of these pills, place one pill under the tongue. Relief will be almost instantaneous. Other first aid procedures include providing supplemental oxygen, reassurance, comfort, monitoring vital signs, and transporting the victim to a medical treatment facility.

### Acute Myocardial Infarction

Acute myocardial infarction results when a coronary artery is severely occluded by arteriosclerosis or completely blocked by a clot. The pain associated with myocardial infarction is similar to that of angina pectoris but is longer in duration, not related to exertion or relieved by nitroglycerin, and leads to death of heart-muscle tissue. Other symptoms are sweating, weakness, and nausea. Additionally, although the patient's respirations are usually normal, his pulse rate increases and may be irregular, and his blood pressure falls. The victim may have an overwhelming feeling of doom. Death may result.

First aid for an acute myocardial infarction includes

- reassurance and comfort while placing the victim in a semi-sitting position;
- loosening of all clothing;
- carefully maintaining a log of vital signs, and recording the history and general observations;
- continuously monitoring vital signs and being prepared to start CPR;
- starting a slow intravenous infusion of 5% dextrose solution in water;
- administering oxygen; and
- quickly transporting the victim to a medical treatment facility.

### Congestive Heart Failure

A heart suffering from prolonged hypertension, valve disease, or heart disease will try to compensate for decreased function by increasing the size of the left ventricular pumping chamber and increasing the heart rate. This condition is known as congestive heart failure. As blood pressure increases, fluid is forced out of the blood vessels and into the lungs, causing pulmonary edema. Pulmonary edema leads to rapid shallow respirations, the appearance of pink frothy

bubbles at the nose and mouth and distinctive rattling sounds (known as **rales**) in the chest. Increased blood pressure may also cause body fluids to pool in the extremities.

Emergency treatment for congestive heart failure is essentially the same as that for acute myocardial infarction. Do not start CPR unless the patient's heart function ceases. If an intravenous line is started, it should be maintained at the slowest rate possible to keep the vein open since an increase in the circulatory volume will make the condition worse. Immediately transport the patient to a medical treatment facility.

## CONVULSIONS

Convulsions, or seizures, are a startling and often frightening phenomenon. Convulsions are characterized by severe and uncontrolled muscle spasms or muscle rigidity. Convulsive episodes occur in one to two percent of the general population.

Although epilepsy is the most widely known form of seizure activity, there are numerous forms of convulsions that are classified as either central nervous system (CNS) or non-CNS in origin. It is especially important to determine the cause in patients who have no previous seizure history. This determination may require an extensive medical workup in the hospital. Since epilepsy is the most widely known form of seizure activity, this section will highlight epileptic seizure disorders.

**Epilepsy**, also known as seizures or fits, is a condition characterized by an abnormal focus of activity in the brain that produces severe motor responses or changes in consciousness. Epilepsy may result from head trauma, scarred brain tissue, brain tumors, cerebral arterial occlusion, fever, or a number of other factors. Fortunately, epilepsy can often be controlled by medications.

**Grand mal seizure** is the more serious type of epilepsy. Grand mal seizure may be—but is not always—preceded by an aura. The victim soon comes to recognize these auras, which allows him time to lie down and prepare for the seizure's onset. A burst of nerve impulses from the brain causes unconsciousness and generalized muscular contractions, often with loss of bladder and bowel control. The primary dangers in a grand mal seizure are tongue biting and injuries resulting from falls. A period of sleep or mental confusion follows this type of seizure. When full consciousness returns, the victim will have little or no recollection of the attack.

**Petit mal seizure** is of short duration and is characterized by an altered state of awareness or partial loss of consciousness, and localized muscular contractions. The patient has no warning of the seizure's onset and little or no memory of the attack after it is over.

First aid treatment for both types of epileptic seizure consists of protecting the victim from self-injury. Additional methods of seizure control may be employed under a medical officer's supervision. In all cases, be prepared to provide suction to the victim since the risk of aspiration is significant. Transport the patient to a medical treatment facility once the seizure has ended.

## DROWNING

Drowning is a suffocating condition in a water environment. Water seldom enters the lungs in appreciable quantities because, upon contact with fluid, laryngeal spasms occur, and these spasms seal the airway from the mouth and nose passages. To avoid serious damage from the resulting hypoxia, quickly bring the victim to the surface and immediately—even before the victim is pulled to shore—start artificial ventilation. Do not interrupt artificial ventilation until the rescuer and the victim are ashore. Once on dry ground, quickly administer an abdominal thrust (Heimlich maneuver) to empty the lungs, and then immediately restart the ventilation until spontaneous breathing returns. Oxygen enrichment is desirable if a mask is available.

Remember that an apparently lifeless person who has been immersed in cold water for a long period of time may be revived if artificial ventilation is started immediately.

## PSYCHIATRIC EMERGENCIES

A psychiatric emergency is defined as a sudden onset of behavioral or emotional responses that, if not responded to, will result in a life-threatening situation. Probably the most common psychiatric emergency is the suicide attempt. A suicide attempt may range from verbal threats and suicidal gestures to a successful suicide. Always assume that a suicide threat is real; do not leave the patient alone. In all cases, the prime consideration for a Hospital Corpsman is to keep patients from inflicting harm to themselves and to get them under the care of a trained psychiatric professional. When dealing with suicidal gestures or attempts, treat any self-inflicted wounds appropriately.

In the case of ingested substances, do not induce vomiting in a patient who is not awake and alert. For specific treatment of ingested substances, refer to the section on poisons in chapter 5.

There are numerous other psychiatric conditions that would require volumes to expound upon. In almost all cases, appropriate first aid treatment consists of a calm, professional, understanding demeanor that does not aggravate or agitate the patient. With an assaultive or hostile patient, a "show of force" may be all that is required. Almost all cases of psychiatric emergencies will present with a third party—]often the family or friend of the patient—who has recognized a distinct change in the behavior pattern of the patient and who is seeking help for them.

## DERMATOLOGIC EMERGENCIES

Most dermatologic cases that present as emergencies are not real emergencies. The patient perceives them as such because of the sudden presentation and/or repulsive appearance or excessive discomfort. Treat most dermatologic conditions symptomatically. The major exception to symptomatic treatment is **toxic epidermal necrolysis** (TEN).

Toxic epidermal necrolysis is a condition characterized by sudden onset, excessive skin irritation, painful erythema (redness of skin produced by congestion of the capillaries), **bullae** (large blisters), and exfoliation of the skin in sheets. TEN is also known as the **scalded skin syndrome** because of its appearance. TEN is thought to be caused by a staphylococcal infection in children and by a toxic reaction to medications in adults.

Since skin is the largest single organ of the body and serves as a barrier to infection, prevention of secondary skin infection is very important. Treatment of skin infections consists of isolation techniques, silver nitrate compresses, aggressive skin care, intravenous antibiotic therapy and, in drug-induced cases, systemic steroids.

## EMERGENCY CHILDBIRTH

Every Hospital Corpsman must be prepared to handle the unexpected arrival of a new life into the world. If the Corpsman is fortunate, a prepackaged sterile delivery pack will be available. This pack will contain all the equipment needed for the normal delivery of a healthy baby. If the pack is not available, a Hospital Corpsman will require imaginative improvisation of clean alternatives.

When faced with an imminent childbirth, the Hospital Corpsman must first determine whether there will be time to transport the expectant mother to a hospital. To help make this determination, the Corpsman should try to find out

- if this will be the woman's first delivery (first deliveries usually take much longer than subsequent deliveries);
- the time between contractions (if less than 3 minutes, delivery is approaching);
- if the mother senses that she has to move her bowels (if so, then the baby's head is well advanced down the birth canal);
- if there is crowning (bulging) of the orifice (crowning indicates that the baby is ready to present itself); and
- how long it will take to get to the hospital.

The Corpsman must weigh the answers to these questions and decide if it will be safe to transport the patient to the hospital.

Prior to childbirth, a Corpsman must quickly "set the stage." The mother must not be allowed to go to the bathroom since straining may precipitate delivery. Do not try to inhibit the natural process of childbirth. The mother should lie back on a sturdy table, bed, or stretcher with a folded sheet or blanket placed under her buttocks for absorption and comfort. Remove all the patient's clothing below the waist, bend the knees, move the thighs apart, and drape her lower extremities with clean towels or sheets. Don sterile gloves, or, if these are not available, rewash your hands.

In a normal delivery, your calm professional manner and sincere reassurance to the mother will reduce her anxiety and make the delivery easier for everyone. Help the woman rest and relax as much as possible between contractions. During a contraction, deep, open-mouth breathing will relieve some pain and straining. As the child's head reaches the area of the rectum, the mother will feel an urgent need to defecate. Reassurance that this is a natural feeling and a sign that the baby will be born soon will help alleviate her apprehension.

Watch for the presentation of the top of the baby's head. Once the head appears, take up your station at the foot of the bed and gently push against the head to keep it from emerging too quickly. Allow it to come

out slowly. As more of the head appears, check to be sure that the umbilical cord is not wrapped around the neck. If it is, either gently try to untangle the cord, or move one section over the baby's shoulder. If neither of these actions is possible, clamp the cord in two places, 2 inches apart, and cut it. Once the baby's chin emerges, support the head with one hand and use the bulb syringe from the pack to suction the nostrils and mouth. Before placing the bulb in the baby's mouth or nose, compress it; otherwise, a forceful aspiration into the lungs will result. The baby will now start a natural rotation to the left or right, away from the face-down position. As this rotation occurs, keep the baby's head in a natural relationship with the back. The shoulders appear next, usually one at a time.

> **NOTE:** From this point on, it is essential to remember that the baby is **VERY** slippery, and great care must be taken so that you do not drop it. The surface beneath the mother should extend at least 2 feet out from her buttocks so that the baby will not be hurt if it does slip out of your hands. Keep one hand beneath the baby's head, and use the other hand to support its emerging body.

Once the baby has been born, suction the nose and mouth again if breathing has not started. Wipe the baby's face, nose, and mouth clean with sterile gauze. Your reward will be the baby's hearty cry.

Clamp the umbilical cord as the pulsations cease. Use two clamps from the prepackaged sterile delivery pack, 2 inches apart, with the first clamp 6 to 8 inches from the navel. Cut the cord between the clamps. For safety, use gauze tape to tie the cord 1 inch from the clamp toward the navel. Secure the tie with a square knot. Wrap the baby in a warm, sterile blanket, and log its time of arrival.

The **placenta** (afterbirth) will deliver itself in 10 to 20 minutes. Massaging the mother's lower abdomen can aid this delivery. Do not pull on the placenta. Log the time of the placenta's delivery, and wrap it up for hospital analysis.

Place a small strip of tape ( ½ -inch wide), folded and inscribed with the date, time of delivery, and mother's name, around the baby's wrist.

## COMPLICATIONS IN CHILDBIRTH

Unfortunately, not all deliveries go smoothly. The following sections cover various complications in childbirth.

### Breech Delivery

A breech delivery occurs when the baby's legs and buttocks emerge first. Follow the steps for a normal delivery, and support the lower extremities with one hand. If the head does not emerge within 3 minutes, try to maintain an airway by gently pushing fingers into the vagina. Push the vagina away from the baby's face and open its mouth with one finger. Get medical assistance immediately.

### Prolapsed Cord

If the cord precedes the baby, protect it with moist, sterile wraps. If a physician cannot be reached quickly, place the mother in an extreme shock position. Give the mother oxygen, if available, and gently move your gloved hand into the vagina to keep its walls and the baby from compressing the cord. Get medical assistance immediately.

### Excessive Bleeding

If the mother experiences severe bleeding, treat her for shock and give her oxygen, if available. Place sanitary napkins over the vaginal entrance and rush her to a hospital.

### Limb Presentation

If a single limb presents itself first, immediately get the mother to a hospital.

## SUMMARY

A medical emergency can occur at anytime. You must be prepared to act expeditiously and confidently, whether you are in a combat situation, on board a naval vessel, or at the Navy Exchange. This chapter covers the preliminary steps you should follow when managing sick or injured patients. The preliminary emergency steps include triage, patient assessment, and, when needed, basic life support. Other related topics covered in this chapter are breathing aids, shock, diagnosis and emergency treatment procedures for medical conditions and injuries, morphine use for pain relief, and other common emergencies. In the following chapters, diagnosis and emergency treatment procedures for medical conditions and injuries will be discussed.